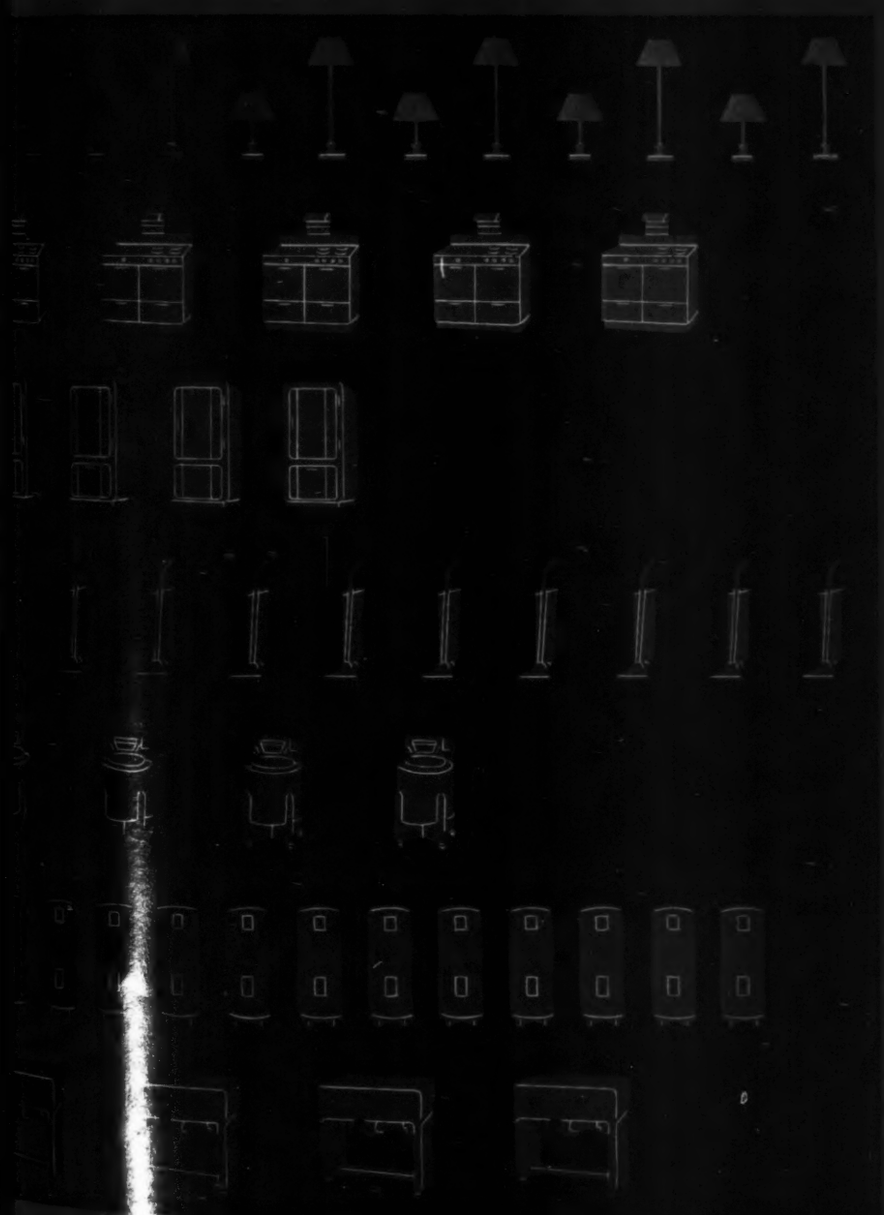
Electrical World

MARCH 9, 1940



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Slice 1 ampere into 500,000 parts!

—each part a power plant for this WESTON Sensitrol Relay!

WESTON Model 705 Sensitrol

The most sensitive direct acting relay known handling 5 watts at 110 volts on its magnetic contacts . . . operates direct from photocells, thermocouples, resistance bulbs and electronic circuits . . . fixed or adjustable contacts . . . provides positive control at energy levels as low as 1 millivolt or 2 microamperes . . . made in hand reset and solenoid reset types.

Whether you are using sensitive relays in existing circuits, or considering their application for new products, it will pay you to submit your problem to WESTON. For the broad WESTON line includes sensitive relays of many types; including the "high sensitivity – high contact capacity" Model 705, as well as time delay and power relays designed to operate from the sensitive relay contacts. Then, too, from WESTON'S long experience in solving all types of relay problems, they probably will have a practical answer to yours. Weston Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark, New Jersey.

WESTON *Instruments*

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Time Delay Relays (Model 613) Compensated bi-metal operation... single or double circuit . . . provides time delay of 15 seconds to 1 minute between initial impulse and operation . . . handles up to 25 watts at 110-volts output.

Sensitive Indicating Relays (Model 730) Designed specifically for alarm circuit use where current is normally held at 2 milliamperes... standard model serves as indicator over 0-4 milliampere range, with contacts at 1 and 3 milliamperes . . . compact and inexpensive.

Power Relays (Model 630) Electromagnetic type with one to four mercury switch contacts . . . designed particularly for use with sensitive relays to supply output energy up to 1000 watts . . . operate on 6 volts DC, or from transformer rectifier unit.

Sensitive Relays (Model 30) Permanent magnet, movable coil operation . . . for circuits up to 200 milliamperes, 6 volts, DC . . . in types for "high-low" voltage (or current) control, and for regulation of voltage (or current) within 1%. Also "microampere" type, operating from high-side to low-side at a minimum differential of 15 microamperes.

Pioneering

Last month in fourteen cities pioneers in American industry were honored. The occasion was the 150th birthday of our patent system.

Some five hundred and seventy-two men were thus honored for their contributions to added employment, better ways of doing things, better national economy. These are not old men. For the most part, they are men still engaged in useful work. Many of them are decidedly young.

It was startling to observe their general youth because we are accustomed to think of pioneers as men who worked years ago and achieved big things in history. If we stop to think, however, pioneering is merely going as far as human experience will take us, and then striking out for ourselves in unfamiliar territory. If that be so, then every day holds forth possibilities for new pioneering.

In that thought lies the only permanent relief that we or any other people have against mounting unemployment. Our frontiers are not gone. The old ones perhaps, but what of the new ones?

Pioneering is predicated entirely on opportunity. Our forefathers would not have undertaken the hardships of colonization if it had not been for the opportunities offered.

Are the opportunities any less today than they were ten, twenty, fifty years ago? When we consider the complexity of the problems, the size of industry, the unfilled needs created by each advance in the art of living or in production, it becomes evident that our problem today is not a lack of opportunity for pioneering so much as a lack of the vision that makes pioneers.

Here this country is doing a volume of business close to its peak year of 1929, but business is jittery and the government is spending money lavishly to try to sweep back the tide of unemployment. We are shortening the hours, and all that does is to bring a new wave of mechanization.

The way out never was gained by burning the house over one's head to keep warm. Something new must be found to produce more employment. And here is where the pioneer is needed.

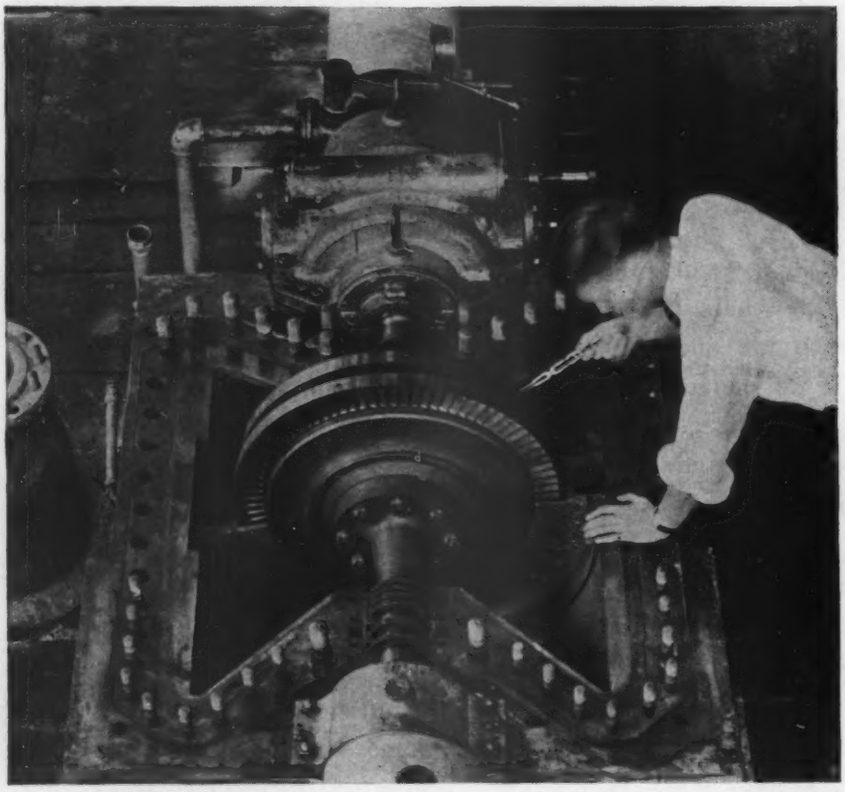
Perhaps would-be pioneers are handicapped by not knowing what is needed. Some people think that what we need is a new automobile industry. That would help, of course, but while we are looking for that magic new business which will absorb millions of people, we need to eat. There are hundreds of needs waiting for exploration. They aren't as spectacular as the big ideas, perhaps, but in the aggregate they will accomplish as much and probably faster.

Perhaps it wouldn't be a bad idea for some organization to take an inventory of the things needed. Maybe our own electrical industry could be persuaded to start. Let's give our pioneers-to-be this encouragement—for whoever adds man-hours of new employment adds a new defense to any attack on our national economy.

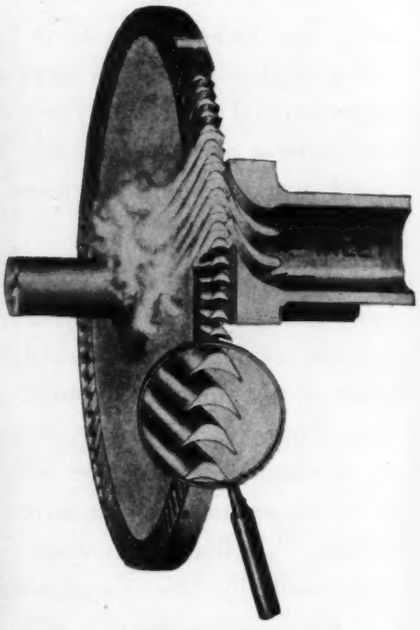
Turbine Blade Research Points to Solution of Vibration Troubles

Avoidance and damping of resonance indicated as crux of problem of assuring impulse blade life for superposed turbines, particularly those operated at partial loads

FLOYD T. HAGUE, Engineering Manager Steam Division,
Westinghouse Electric & Manufacturing Company, South Philadelphia, Pa.



FOR THE BLADE-VIBRATIONS RESEARCH only the first two rows of impulse blades of a 1,000-kw. turbine were employed. The man is changing a mirror from one blade to a differently designed one for a new series of observations



5,000,000 PASSAGES per day through nozzle streams may result in 200,000,000 vibrations in a day's work of a typical superposed turbine blade

IN THE FIRST impulse wheels of a few of the superposed turbines in service there developed certain blade failures of kinds which had not been experienced (and need not be feared) with conventional turbines. These root failures generally happened soon after the initial operation of the turbine units. Circumstances indicated a combination and concomitance of influences which conspire to make very critical the stresses on the first row of blades.

Several months of intensified and somewhat unique research have segregated the contributory factors. Both the phenomenon and the apparent solution are matters of resonance and damped vibrations. An optical system using mirrors attached to the blades has enabled the photographing of blade vibrations while operating at 1,500 to 6,000 r.p.m. The optical lever functions through the shaft of the experimental turbine and the beam of light doubles back through the steam (400 lb., 600° F).

To obtain good superposed turbine economy at partial loads the steam is fed to the first impulse wheel at only a portion of its periphery. A blade moving 350 miles an hour cuts across a steam flow having a velocity of some 1,200 miles an hour. Each blade passes the nozzles some 5,-

000,000 times in the course of a full day's operation. Incidentally, each individual impulse blade in a typical 50,000-kw. superposed turbine develops about 100 hp. as its share of the total. That calls for strength and massiveness of the blade merely to withstand the bending moments and centrifugal stresses at the high steam temperature.

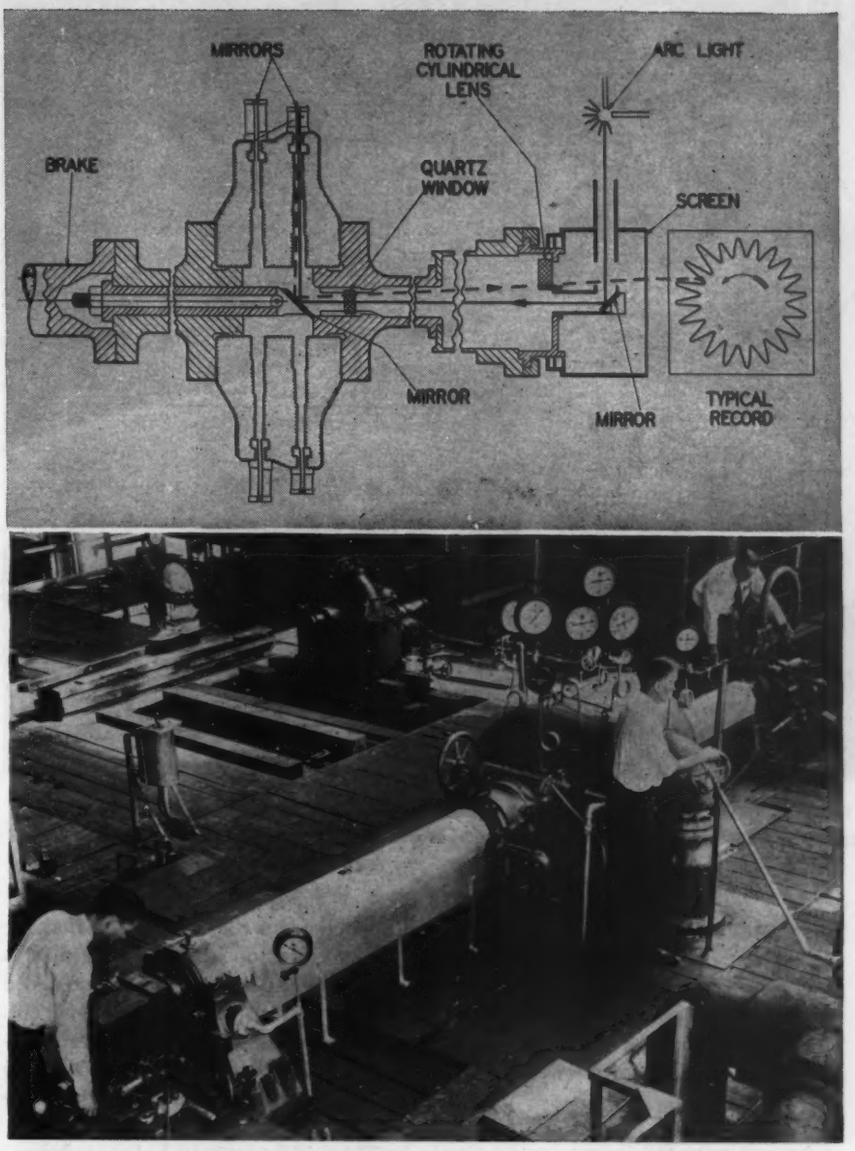
But unfortunately mere brute strength and size is no answer to fatigue failure from blade vibration any more than increasing the shaft diameter solved the mild epidemic of failures experienced with early Diesels. The solution there was to get "off resonance," and the same answer seems to be indicated here. In fact, stiffening the blade only makes matters worse by raising the natural "tuning-fork" frequency of the blade vibration and thus increasing the risk of resonance with the gust frequency at the nozzles.

Experimental Turbine Set Up

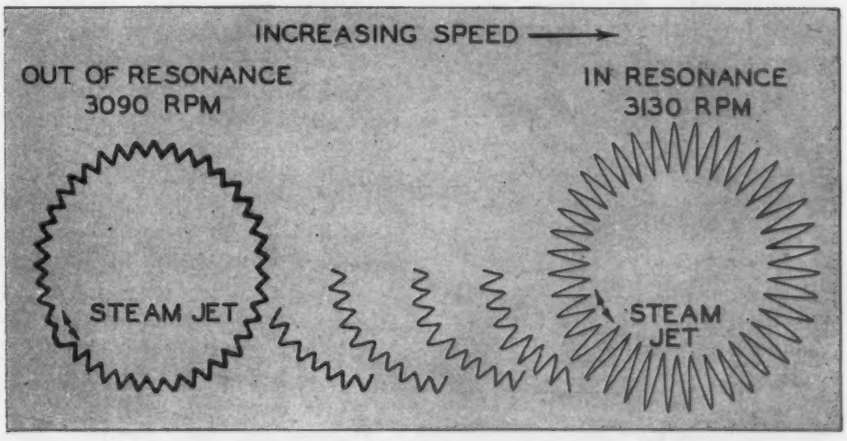
The natural vibration of a typical blade is in the neighborhood of 2,500 cycles per second at steam temperature. Each blade makes (at 60 cycles with two-pole generator) 60 revolutions per second. That means 41.2 complete vibrations of a blade take place in one revolution. With some 5,000,000 revolutions made per day each blade can thus be subjected to some 200,000,000 complete cycles of vibration in a day. It is not strange that a few blades failed after a few hours operation—it usually takes only 10,000,000 to 20,000,000 cycles to induce a fatigue failure for parts that are likely to fail at all.

To explore this problem an experimental turbine carrying only two rows of impulse blading was set up at the factory. Since nothing short of actual photographing of blade oscillation about its root promised to give adequate and accurate records of the phenomena and indication of the stresses, this was made the objective of the study. An ingenious optical system was devised to facilitate the determination to have the blades write their own life history on photographic film. More than 30,000 photographs have been taken under a wide range of conditions of speed, acceleration, deceleration, temperature, pressure and of blade designs and assemblies. Pictures are usually taken every half second during significant intervals.

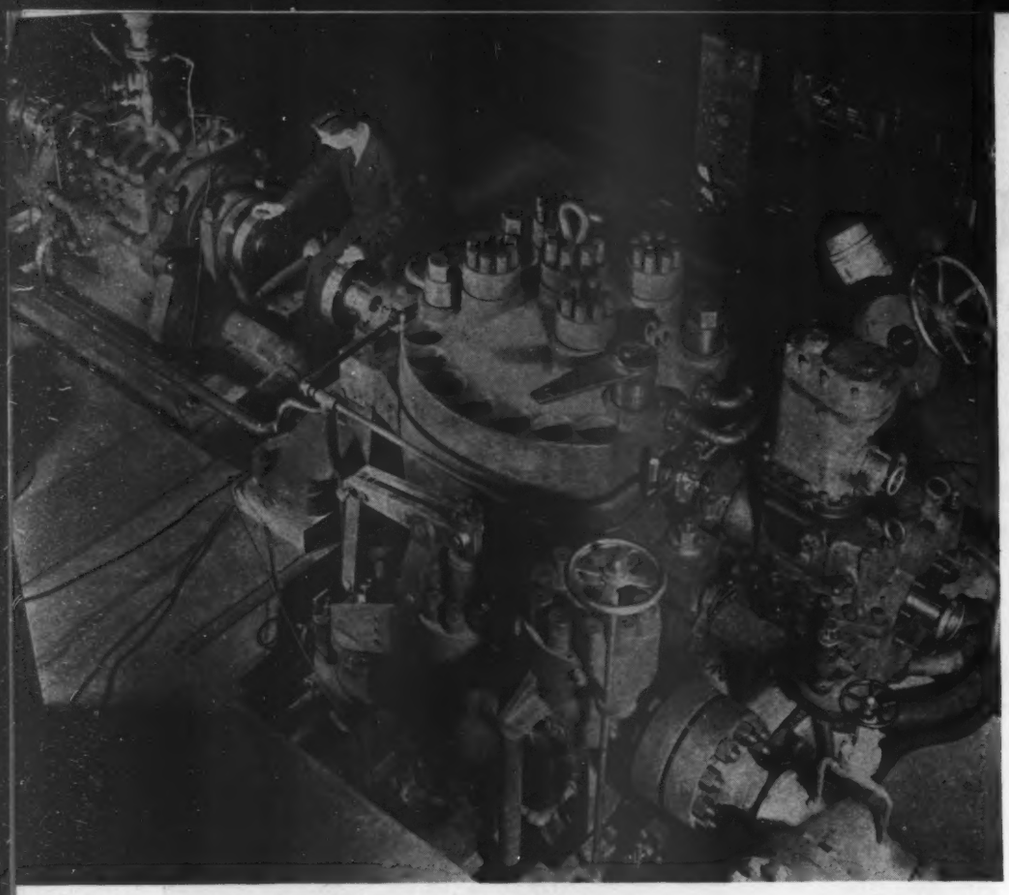
Magnification by the optical lever



MIRRORS REVEAL SECRETS of blade vibration. Above—Optical lever multiplies few thousandths of blade displacement into about ½-inch range at the film record. The light beam passes twice through a quartz sealing window and several feet through the superheated steam in its double-back path. Below—Long tube affords opportunity for adequate magnification of vibration in the film record



BLADE RECORDS its own vibration history photographically. Slight increase in turbine speed shown to shift blade into resonance with steam jet frequency. The amplitude increases markedly under this adverse condition and the internal molecular friction which provides the damping is destructive of the blade



FULL SIZE IMPULSE WHEEL of 50,000-kw. unit installed at Schuylkill plant of Philadelphia Electric Company for continuation of developmental research under actual loading conditions

is about 250, and thus a 0.002 in. deflection of the tip of the blade becomes a serration of 0.5 in. extreme amplitude on the 4-in. circular pattern traced on the film.

The vibration amplitude increases as a blade enters the steam jet and, after emergence, the amplitude decreases somewhat under the natural damping influences. But the damping, unless artificially enhanced, resides primarily in internal molecular friction, and that is what may lead to ultimate failure unless counteracted. Load on the turbine has relatively little to do with the amount and persistence of blade vibration.

Blades Like Tuning Forks

But resonance is a large factor. If the gust-shock frequency of blade passages through the nozzle jets is an exact multiple of the blade-vibration frequency (or vice versa) the situation is bad. This is true because (as shown in the sawtooth illustration) the synchronism and in-phase relationship then tends to raise the blade amplitude to extreme limits. But if the two phenomena are out of resonance and out of phase a new régime of blade vibrations has to be set up incidental to each gust impulse. Corroborative evidence gleaned from the research is that the blade vibration stress varies over a four-to-one range when turbine speed is changed as little as 2 per cent. It is this disproportionate relationship which lies at the bottom of such isolated blade failures as have occurred.

The widely used 12 per cent chrome turbine-blade steel has, fortunately, ten times as much inherent internal damping as nickel-chrome and chrome-nickel steels which might be used because they have other good properties under high temperature conditions. Those steels would present three to four times as much range of amplification of blade stress for rotor speed changes at constant load as 12 per cent chrome steel because of their power damping characteristic. Conversely, if the damping ability of the conventional steel could be increased ten times by use of artificial damping the amplification of blade stress could be reduced to 2/1. All this merely emphasizes the fact that damping is the factor of safety for impulse blades.

Several significant things have thus been revealed about damping in the research:

1. Damping increases with blade stress and is extremely low at low stress.
2. Damping characteristics of different steels vary widely.
3. Damping decreases with increased frequency of vibration. This means that the increased stiffness of heavier blades does not result in appreciably lower blade stresses.
4. Damping decreases rapidly at higher operating temperatures, particularly beyond 750° F. At 1,000° F. the damping is only one-third as much as at room temperature and is decreasing precipitously.

A steel capsule partly filled with material that is fluid at turbine temperatures can be inserted in a blade as a means of artificial damping and thus maintain full damping ability up to 1,500° F. It is quite possible that such an expedient may be dictated by future operating requirements but it is not implied that it is necessary under present-day levels of steam temperature and pressure.

Schuylkill Plant Research

Building on the experience with this experimental turbine at South Philadelphia, a second one with full size impulse wheel (duplicate of the impulse stage of the 50,000 kw. West Penn unit) was built for research study of blade performance under 1,250 lb., 900 deg. steam operating conditions. This turbine with its 10,000-kw. generator and 15,000 hp. water-brake is in testing operation in the Schuylkill Plant of the Philadelphia Electric Company. This turbine takes steam from the station 1,250-lb. steam lines and exhausts into the low-pressure 240-lb. lines, permitting its operation as a superposed unit without interference with the station's regular operation. This turbine is built solely for research purposes and has many special constructional features, including single and double blades, separate blade dampers, different shroud attachments, and various blade groupings. The optical system will record the performance of sixteen different blade combinations. Two rotors are being built with different blade design and the coupled 10,000-kw. generator will permit life tests by loading into the P.E. system.

Reference to this unit acknowledges the joint research relationship of Westinghouse with the Philadelphia Electric Company. The company is making available the use of station, operators and steam supply. This contribution to research on a central-station industry problem is a tribute to the broad viewpoint of the Philadelphia Electric management.

Luminous Ceiling Gives 100 Ft.-Candles for Drafting

Shadow-free light from continuous fluorescent ceiling — 1,154 30-watt lamps in special abutting fixture give a natural daylight effect with 5 watts per square foot load

EDWIN D. TILLSON, Testing Engineer, Lighting Laboratory, Commonwealth Edison Company

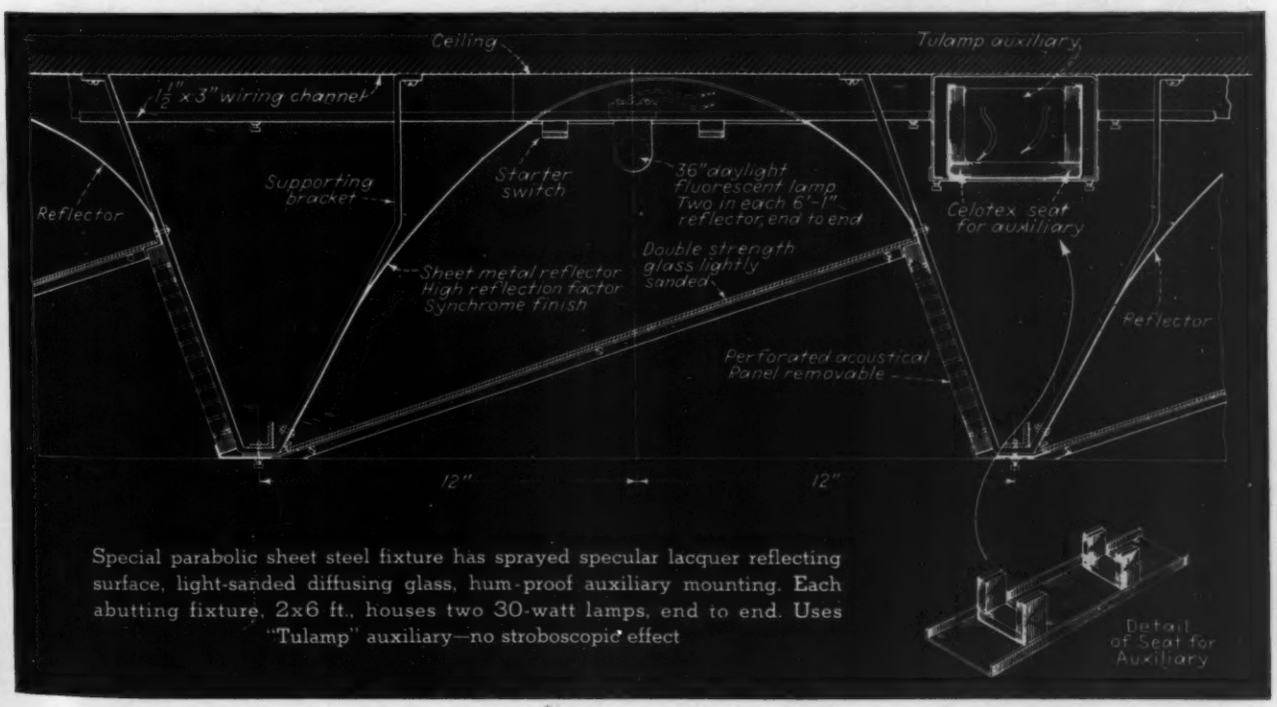
DOMINATING the lighting design of Commonwealth Edison Company's newly consolidated drafting rooms is recognition of the manifest destiny of the fluorescent lamp as the utilities see it; namely, not as an expedient to match present foot-candles at a fraction of the present energy consumption, but rather to take full advantage of the most wonderful opportunity that the lighting fraternity has ever had—to graduate to somewhere near the quality and quantity of ideal natural daylight illumination at a reasonable cost.

Here at a delivered fixture cost of $10,000 (tubes, auxiliaries and switches not included) equivalent to about seven days payroll for the space lighted, a fluorescent lighting installation is secured which gives a maximum horizontal illumination at 37 inches of 103.1 ft.-candles of shadowless lighting, with a wattage density of 5 watts per square foot.

In the design former concepts of detached units on some sort of spacing were abandoned to attain the recognized objective for drafting rooms of a light source covering sufficient ceiling area to eliminate entirely shadow and shine. Abutting fixtures of special design, each housing two 30-watt, 36-in. T-8 daylight fluorescent lamps, cover the whole ceiling area. Fixtures were arranged in a sawtooth configuration and closed at the bottom with lightly etched clear glass. There will be 1,154 lamps in the complete installation, with the two tandem lamps in each 2x6-ft. fixture controlled by a "Tulamp" high power factor auxiliary.

Previous Installation

The type of lighting used heretofore has been totally indirect, using 500-watt incandescent lamp bulbs on 10-ft. centers. This arrangement theoretically furnished an illumination of 25 ft.-candles, but actually the intensity dropped off to about one-half this value at or near the walls,



Special parabolic sheet steel fixture has sprayed specular lacquer reflecting surface, light-sanded diffusing glass, hum-proof auxiliary mounting. Each abutting fixture, 2x6 ft., houses two 30-watt lamps, end to end. Uses "Tulamp" auxiliary—no stroboscopic effect

BEFORE—Twenty-five foot-candles with incandescent indirect fixtures on 10-ft. centers, 10 ft. 8 in. ceiling—seats by windows at premium

where many of the drafting tables were located.

Twenty-five foot-candles is not considered to be anywhere near the value required for work of this nature. The almost universal desire among draftsmen is for a good natural-daylight location near the windows, particularly those with north exposure, where the intensity ordinarily ranges from 100 to 300 ft.-candles under fair weather conditions and for at least six months of the year.

To obtain 100 ft.-candles with incandescent lamp bulbs would require approximately 20 watts per square foot, which is unthinkable from the standpoint of the radiant heat generated, even supposing it were available. Actually, 5 watts per square foot is available in building feeder capacity. This is well above the usual allowance for downtown office buildings in Chicago.

The Shadow Problem

It was, therefore, natural when the new drafting room was first discussed to consider fluorescent lamps as the one likely solution. Accordingly, various fluorescent fixtures were purchased and placed over the drafting tables for trial. Banks of lamps from one to six were mounted so that they might be raised or lowered, shifted from right to left, forward and backward. Diffusing elements, louvers and other shielding devices were also tried. These experiments confirmed what was discovered years ago in connection with drafting rooms, namely, that the light source must cover such a large area as entirely to eliminate shadow and shine.

Common fault in drafting rooms equipped with direct lighting fixtures in the past, whether incandescent, fluorescent or mercury, has been that the depth of shadow produced by the T-square, triangle, or both, was so pronounced as to confuse the edge of the shadow with the lines being drawn, particularly lines being traced. If the fixtures are placed sufficiently to the front to avoid T-square shadow, then there is pencil, paper or ink shine, particularly when tracing, even with the mat surface of the tracing cloth uppermost. If the fixture is positioned over to the left sufficiently to avoid this "shine" and also to avoid triangle shadow (when triangle is at the left side of board) then the falling off of light on the right side of the drawing board is serious.

The need for a large light source area to eliminate these problems eventuated in totally indirect lighting for drafting rooms in the past, and since. In such cases the entire ceiling is the light source.

However, at the present time totally indirect lighting with fluorescent lamps is not practical. The largest unit available in an acceptable color is the 40-watt lamp. In order to build up intensities of 100 ft.-candles or more indirect fluorescent fixtures would be so large as to block most of the light redirected by the ceiling. Weight, expense and poor appearance would also veto the idea.

The problem, therefore resolved itself into direct lighting, but of such a type that the whole ceiling of the room would be luminous.

Abandon Former Concepts

Various large coffers were then built with temporary materials and mounted over the tables. It was still believed that perhaps a compromise might be effected, but as the study progressed it was found that the coffers must abut each other. In other words, these experimenters, like a good many others at the present time, still clung to the idea of detached fixtures on some sort of spacing. This is natural, but it may well be that *in the best application of the fluorescent lamp our former con-*

ceptions of light fixtures must be entirely abandoned.

The fluorescent lamp, while an efficient source, still is sold in small unit packages. Furthermore, with the auxiliaries, etc., it is expensive in first cost. These facts point to the need of conserving the light from these lamps to the utmost. Large specular processed aluminum reflectors were, on the face of things, called for, and yet this material is too high-priced for such a wholesale application. About this time a deflocculated aluminum bronze was brought on the market in the form of a high-bake enamel. Tests showed integrated reflection factor up to 75.5 per cent and non-selective color.

Fixture Design

To establish the downward "kick" over a wide egress area single 30-watt T-8 lamps were placed at the foci of large sheet steel boxes, parabolic in cross-section and sprayed with the specular lacquer previously referred to. The box is closed at the bottom with clear crystal window glass partially etched with sand; that is, in place of the regulation sandblast by compressed air, the sand is merely allowed to fall onto the glass through a distance of approximately 16 in. In ordinary sandblasted glass the pits are so close as not to be separately distinguishable to the naked eye. In the glass here described the pits are relatively wide in spacing and can be separately distinguished. The result is that the brightness of the fluorescent lamp is modified and, further, it is seen against a luminous background which is partly the effect of the reflector and partly of the glass. When the boxes are viewed endwise, or partially so, the sandblast automatically louvers the lamps in proportion of the sine of the angle subtending successive pits in the glass surface.

The complete standard assembly is shown in an accompanying illustration. It consists of two of the sheet-metal boxes referred to, together with wiring channel that carries the wire, lamp receptacles, switch receptacles and "Tulamp" auxiliaries.

The wiring assembly does not touch the reflector box at any point. Where the two intersect a slot is cut with ¼-in. clearance on all sides so that any auxiliary hum there may be is not communicated to the drums, which are resonant under certain conditions. Further, every auxiliary is floated in two small cradles of ¼-in. "Celotex" and does not touch metal at any point.

Sawtooth Configuration

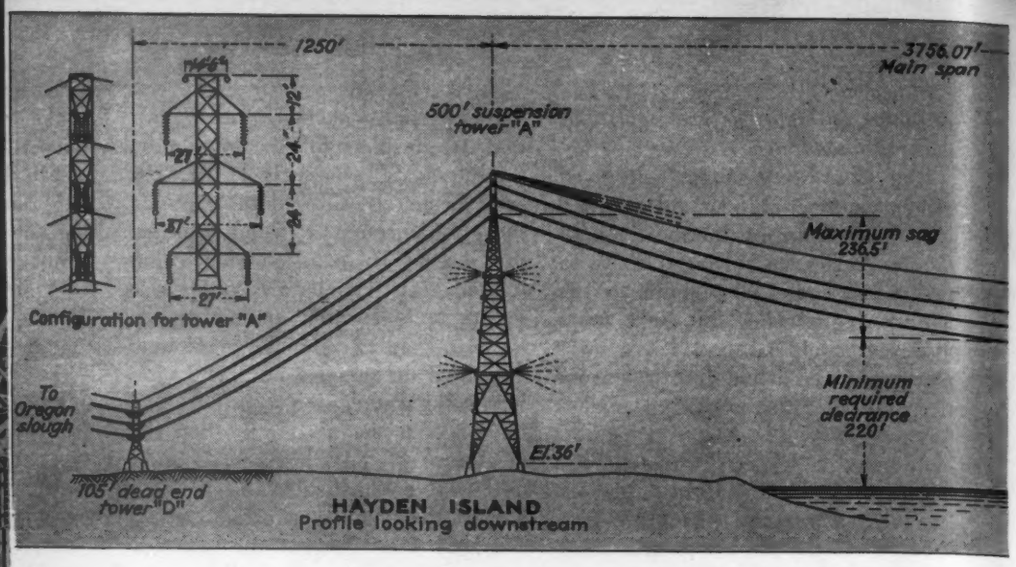
The reasons for the sawtooth rather than a flat arrangement of boxes are:

1. It provides the necessary calculated sound-deadening area (the panels are constructed of acoustic material).

2. It provides an opportunity for offsetting what is psychologically somewhat too blue a flux produced by the daylight fluorescent lamp and obviates the questionable expedient of a small proportion of "white" lamps. The acoustic panels are tinted a light salmon pink; also, the columns and walls of the room.

[*Continued on page 149*]

AFTER—Fluorescent skylight lighting design gives 100 ft.-candles without shadow or shine at 37 in. from floor—note acoustic panel



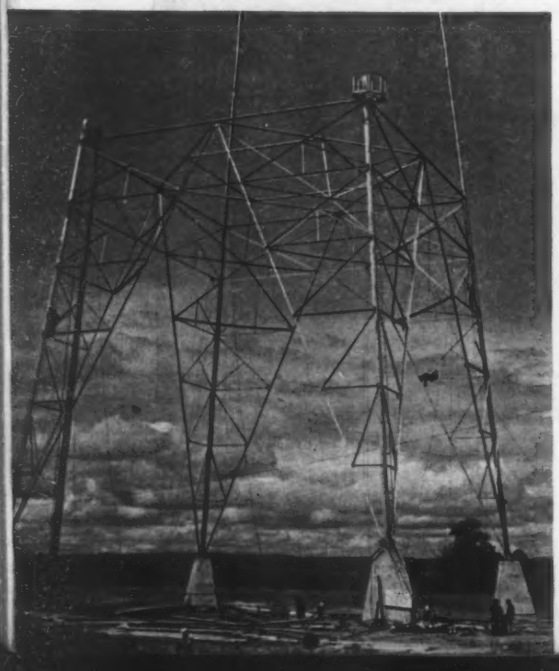
STANDARD cap- and pin-type suspension units used in insulator assemblies

Conductor dead-end assemblies consist of six parallel strings of Westinghouse insulators, each containing eighteen units. These strings are mounted between two cast steel hexagonal yoke plates; upper casting carries double spring assembly for each string. Springs are centered around square shank bolts in manner which permits convenient adjustment of spring lengths under tension for equalizing loads carried by individual strings. Each conductor is supported in suspension by assembly of two double-strings of insulators, each string containing sixteen units. Strings are mounted on double-yoke plates tied at lower end by equalizing bar. Conductors are protected at this point by aluminum armor rods and carried in high-strength suspension clamps.

Ladders, resting nests and platforms with steel floor gratings, steel pipe railings and wire-mesh netting provide comfortable and safe access to all parts of the towers. Airway lighting system includes 1,000-watt floodlights on suspension towers to illuminate catenary in main span.

GIN POLES helped in the erection of the square base steel towers

Lower panels of towers were erected with the use of a 100-ft. center gin pole. Main leg members, 87 ft. long, were thus mounted on sole plates, attached to anchor bolts and then guyed in proper alignment to receive the horizontal panel members and their bracing. Subsequent panels were erected with floating gin pole mounted at corner points of previously completed panels. No construction was allowed to proceed above panel point until all horizontal and side bracing in lower panels had been completely erected and tower alignment checked.



Bonneville Crosses

A. A. OSIPOVICH and F. W. FARR

MECHANICAL and structural design of the 230-kv. Columbia River crossing of the Bonneville power system is a result of compromise among several contradictory factors imposed by navigation and aviation requirements and by manufacturing limitations. While it is the largest of a series of 230-kv. river crossings carrying energy generated at Bonneville Dam into Oregon and Washington, yet it is typical in its basic design characteristics of the others. Its towers are arranged to carry two three-phase circuits in a vertical configuration and two overhead ground wires.

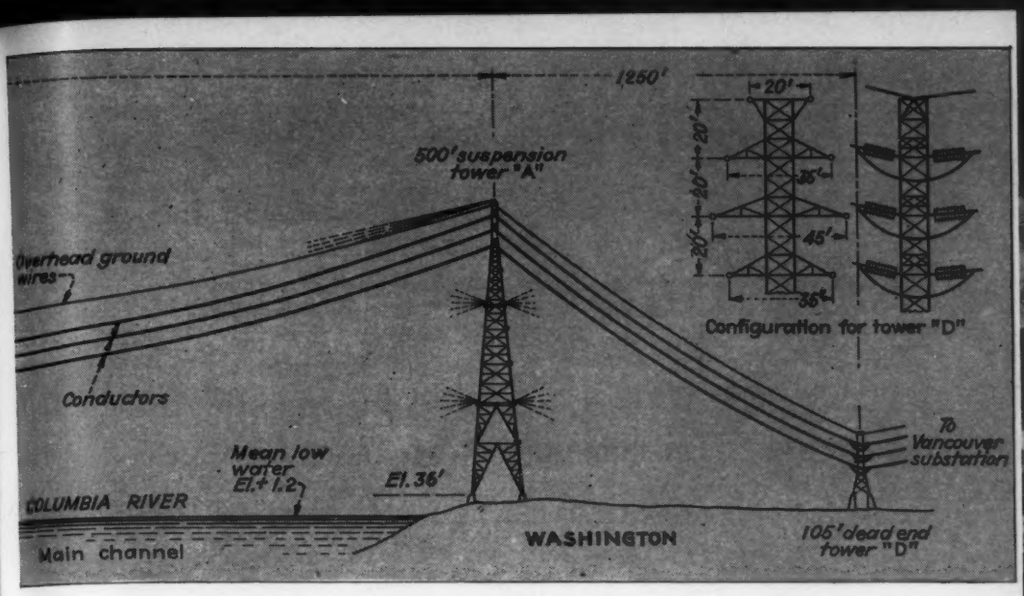
Not Too High

War Department regulations established a minimum vertical clearance for the line of 220 ft. above mean low water at a loading condition resulting in a minimum vertical sag. The crossing is near the Portland, Ore., Municipal Airport and that meant that the towers had to be kept as low as possible.

Electrical studies indicated conductors with a minimum copper equivalent of 500,000 circ.mil, a minimum diameter of 1.08 in. (based on corona limitations) and a maximum 60-cycle resistance of 0.0223 ohm per thousand feet at 20 deg. C. Mechanical and structural considerations dictated a minimum conductor breaking strength of 64,500 lb. To these specifications was added a sag-tension requirement, to reduce the height of towers, which limited the vertical sag under a maximum working tension of 40 per cent of the ultimate strength to 240 ft. in a level span of 3,800 ft. Similar requirements governed the specifications for the steel overhead ground wires. The maximum length to which a conductor of these characteristics could be stranded with the existing facilities of the largest wire manufacturers in the country was 6,500 ft.; this was one of the most important factors in establishing the arrangement and spacing of crossing structures, as shown in the drawing.

Construction Data

Conductor, ground wire and tower design data are listed in accompanying tabulations and construction techniques are illustrated. Towers were fabricated by the Bethlehem Steel Company in its Oakland, Calif., shops and construction of the crossing was done under contract by Fritz Ziebarth of Long Beach, Calif.



the Columbia River

The Bonneville Project

Tower Design Data

	Suspension Tower "A"	Dead-end Tower "D"
Heights above footings, ft.		
to top of ladder railing	504.08	
to ground wires	498.17	105.08
to upper conductor	476.32	85.00
to middle conductor	452.32	65.00
to lower conductor	428.32	45.00
Total estimated weight of tower steel, lb	327,500	60,500
Footings		
elevation at top, ft	+36.0	+36.0
height above ground, ft	"2A," 17; "3A," 17	"1D," 26; "4D," 16
spacing at top, center line to center line	83' 4" x 83' 4"	27' 5" x 27' 5"
reinforced concrete, cu.-yd	"2A," 264; "3A," 264	"1D," 390; "4D," 287
Design conditions		
longitudinal loads		
from broken ground wire	1 at 21,000 lb.	2 at 21,000 lb.
from broken conductor	or 1 at 23,000 lb.	and 6 at 23,000 lb.
transverse wind loads		
on ground wires	2 at 3,000 lb.	2 at 1,450 lb.
on conductors	and 6 at 3,500 lb.	and 6 at 1,750 lb.
on tower structure	13.4 lb. per sq.ft.	on 1.5 x area of one face
vertical loads		
from ground wires	2 at 11,000 lb.	2 at 3,100 lb.
from conductors	6 at 14,300 lb.	6 at 4,600 lb.
from towers (est.)	292,000 lb.	56,000 lb.
Maximum loading conditions	"Heavy;" ½ in. ice and 8-lb. wind	

Conductor and Ground Wire Data

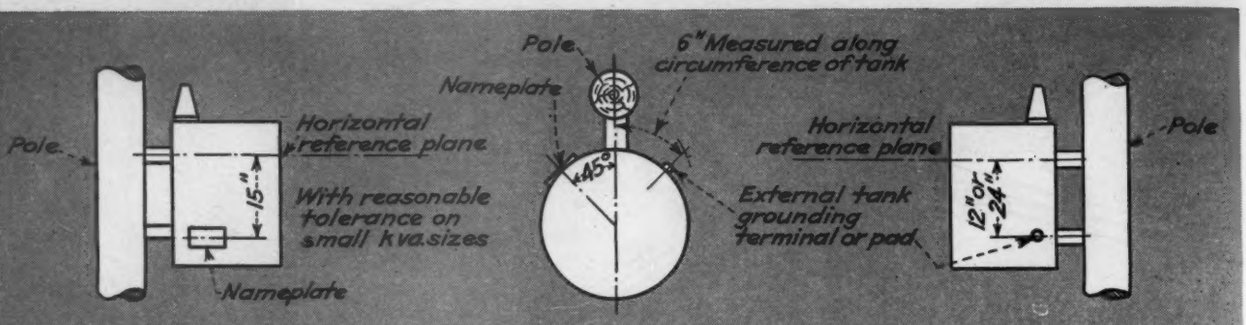
Type of wire	A. C. S. R. special high strength	Ex. high strength galv. steel strand
Stranding Aluminum	44 x 0.1350 in.	
Steel	37 x 0.1029 in.	19 x 0.1520 in.
Total area 2 circ.mil	801,900	
Sq.in.	0.9375	0.340
Copper equiv., circ.mil	531,120	
Outside diameter, in.	1.260	0.750
Weight per lin.ft., lb.	1.8075	1.155
Ultimate strength, rated, lb.	64,500	58,300
Ultimate strength on test, lb.	67,200	64,100
Fittings	Special socket and compression dead-end	Special wedge-type compression dead-end
Insulators	Ball-and-socket suspension type 10 in. diam. x 5¾ in. x 15,000 lb. M. & E. rating	

CONDUCTORS were strung at 60 deg. F. to 14,000-lb. tension and 231-ft. sag

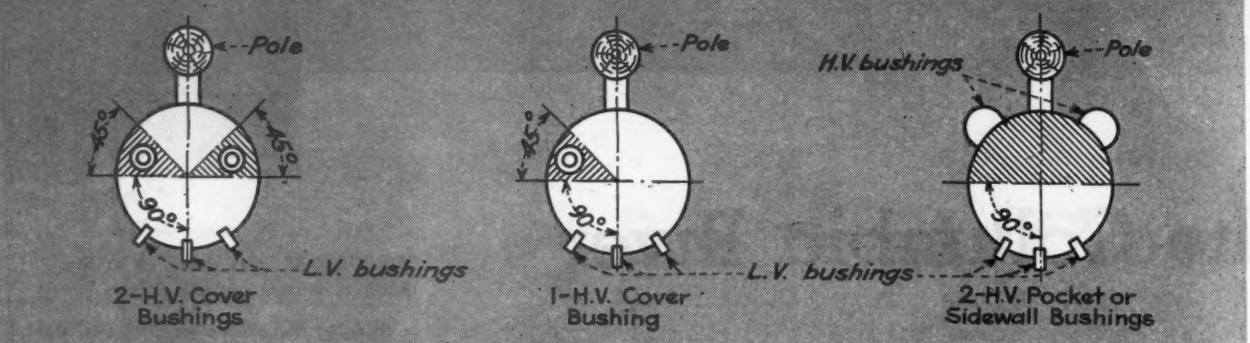
In stringing the conductors a 9/16-in. steel "stinger" line was first carried across the river and over the towers. To the end of the "stinger" was attached the end of a conductor, by means of a forged steel eye attached to the steel core of the conductor, over which was placed a Kellems type sock to apply a gripping hold on the outside aluminum strands. A pair of "Molyhogans" arranged so that a small initial tension was first applied to the aluminum strands completed the assembly, which was flexible enough to be pulled through the 16-in. stringing sleeves without effort or special attention.

Overhead ground wires were strung in a similar manner to a tension of approximately 10,300 lb. with a sag of about 197 ft. Double-drum heavy hoist provided tension necessary to string the conductor and overhead ground wires. A grooved, double-wheel braking machine was placed ahead of the payout reels so that sufficient tension could be maintained in the wires to keep them clear of the water. All sagging was done in the main suspension span.

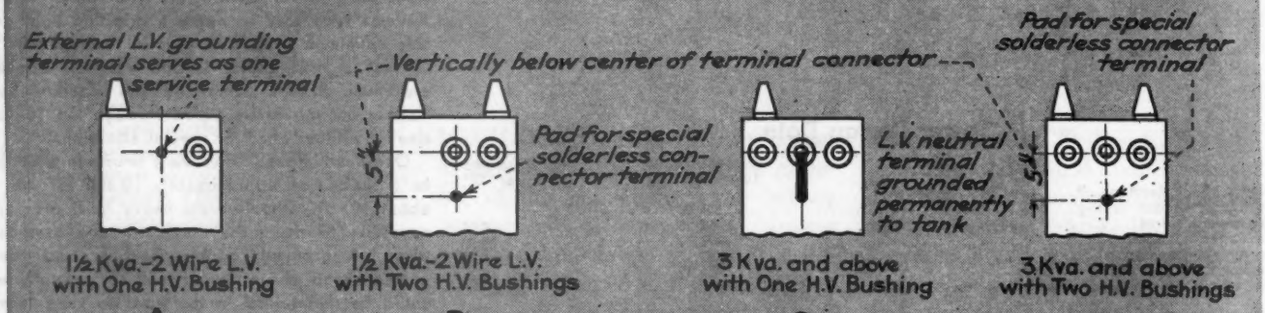
Transits were mounted on one of the suspension towers and a system of targets was placed at previously computed locations on the other suspension tower at intervals corresponding to small temperature increments and permitting accurate interpolation. Submarine telephone lines connecting all four towers of the crossing aided materially in controlling the sagging and stringing operations. Deflection of dead-end towers was carefully observed during stringing and sagging operations and their effect accounted for in placing of suspension insulator assemblies and in final clipping operations.



LOCATIONS OF NAMEPLATE AND TANK GROUNDING TERMINAL OR PAD



LOCATIONS OF HIGH AND LOW VOLTAGE BUSHINGS


External L.V. grounding terminal serves as one service terminal
1½ Kva.-2 Wire L.V. with One H.V. Bushing
A
Vertically below center of terminal connector
5¼"
Pad for special solderless connector terminal
1½ Kva.-2 Wire L.V. with Two H.V. Bushings
B
3 Kva. and above with One H.V. Bushing
C
Pad for special solderless connector terminal
L.V. neutral terminal grounded permanently to tank
5¼"
3 Kva. and above with Two H.V. Bushings
D

LOW VOLTAGE BUSHINGS, LOW VOLTAGE GROUNDING TERMINAL OR PAD AND NEUTRAL CONNECTIONS

1. All angles given looking down on transformer
2. Reference plane is through top of bolt slot in upper support lug
3. High voltage bushings shown in shaded areas
4. Sketches A & B apply to 1½ Kva. transformers without taps and with 2 wire, 120 v. low voltage only
5. Sketches C & D apply to all sizes 3 kva. and above, also to 1½ Kva. transformers with series-multiple low voltage and high voltage taps

LOCATIONS OF BUSHINGS, GROUNDING PROVISIONS AND NAMEPLATE

First report EEI-NEMA joint committee on standards for distribution transformers

Distribution Transformer Benefits by Standardization

Industry agreement on interchangeable mounting, preferred ratings, bushings, ground and terminal locations and accessories for distribution transformers carries advances accentuated by evolution of farm and rural transformer designs

OF MAJOR SIGNIFICANCE to the utility industry is the fruition of efforts to crystallize into an acceptance standard design for distribution transformers the best of the innovations of the last four or five years. Joint work by the transformer manufacturers of N.E.M.A. and the utilities in E.E.I. has thus evolved a new "streamlined" design which provides advantages in stocking and erection by the utilities as well as in reduction of variations in fabrication by the manufacturers. Both objectives as now met can hardly avoid lowering the outlay entailed in providing transformers on distribution systems and later moving them about from time to time as circumstances require.

There is nothing strait-laced about the standardization. Whoever wants to continue special stipulations can continue to have them—in fact, the new pattern has been conceived to embrace most of the good ideas or else make it a relatively simple matter to modify the standard arrangement to meet special prescription. Basically, however, those who adopt the 1940 streamlined pattern can reap whatever gains have been built into it and those who do not can have what they specify, at commensurate cost.

Aim of Standardization

Fundamentally, the primary objectives of the joint committee were to attain the following merits in the now ratified design:

1. A basic or standard transformer embodying essential and indispensable elements and features, all accessory devices to be treated as extras.
2. Interchangeable mounting of all makes, within suitable grouping of sizes.

These were sensed as desirable attributes of an assembly that would reverse the steadily growing trend toward specification of special features. This situation had become so bad by 1936 that almost as many transformers were being ordered with departures from the catalogued standards of the various manufacturers as in conformity with these standard designs. Up to 1930 transformers had largely been ordered by catalogue number and there were manifest advantages in that practice. The adverse trend was accentuated when the "farm transformer" in 1935 broke away from traditional designs.

Evolved From Rural Design

Rural requirements demanded simplification, a more universal mounting arrangement and reduction in cost. In the dash for quick modification to meet those common objectives there arose a rapid chain of developments which not only conspired toward the common purpose, but also had such general merit that they soon found their way rather diffusively into regular lines of distribution transformers. Many of the changes that came with the farm transformer were therefore constructive, but they speeded a multiplicity of specifications for departures from what had been conventional distribution transformers. Growing confusion prompted a logical effort to clarify the situation by incorporating the best advances in a new standard without precluding the use of those which might still logically be needed on properties where they have vogue.

The agreed upon standard involves the following principal features:

Mounting	Grounding terminals
Taps	Drain plugs
Voltage ratio	Lifting lugs
Polarity	Provision for protective devices
Bushings	
Nameplate	

Interchangeable Mounting and Taps

The standardized transformer will be designed for interchangeable use in

1. Bolting directly to the pole, without crossarm.
2. Bolting directly to the pole, coordinated with crossarm.
3. Mounting on crossarm as now commonly done.

In addition to providing for this flexibility, provision has been made for mounting in banks of two or three, for firm resistance to dislodgement by automobile collision and for enhanced working clearances. The combination of new features renders the design suitable for farm, rural, suburban and urban installation. To complete the interchangeability an adapter or "T-crossarm hanger" has been devised in two sizes for crossarm hanging in lieu of conventional hanger irons. There is also a "kicker" as alternate to the kicker crossarm.

A large preponderance of users wanted to omit taps and save their cost on transformers rated 2,400 or 4,800-120/240 volts. In the 7,200-volt and 7,620-volt classes a large number of users also desired to obtain the benefit of reduced cost due to omission of taps where practical. Therefore, the standard 2,400 and 4,800-120/240-volt transformers, 25 kva. and below, have no taps, and the standard 7,200-volt and 7,620-120/240-volt ratings in the smaller

kva. sizes have no taps. Other voltages and ratings will have taps in accordance with a new set of values. Taps are now expressed in percentage of the tapped winding rather than as a percentage representing the amount of tap voltage; that is, a 2½ per cent tap below normal is now expressed on the nameplate as 97½ per cent of the tapped winding.

This departure recognizes the increasing use of pole-type regulators to do a better job of voltage regulation than can be effectuated by changing of taps. Taps inevitably reduce ruggedness, especially in ability to withstand lightning surges. Where individually tapped transformers are wanted to meet seasonal load variations or for service near extremities of long, heavily loaded feeders, these can continue to be had at a proportionate price.

For easier accessibility to read nameplates and to make grounding connections the nameplates and tank grounding terminals are to be located on the sectors of the tank adjoining the pole. The nameplate will be near the bottom of the case at 45 deg. from the transformer-pole center line. The low-voltage grounding terminal will be on the opposite side of the pole center line and near the lower support lug. The terminal will accommodate conductors from No. 8 to No. 2 solid, inclusive. The external low-voltage grounding terminal on the secondary neutral will be common with one stud of the service terminals for 1½-kva. transformers having one high-voltage bushing, but separate for those with two high-voltage bushings. On larger transformers having one high-voltage bushing a permanent link will be installed between the low-voltage neutral and tank. For two-bushing transformers provision is made so that low-voltage neutral can be grounded to the tank, if desired. Grounding of windings is thus brought to the outside of the tank, where its status is immediately visible.

No drain plugs will be provided in the standard transformers.

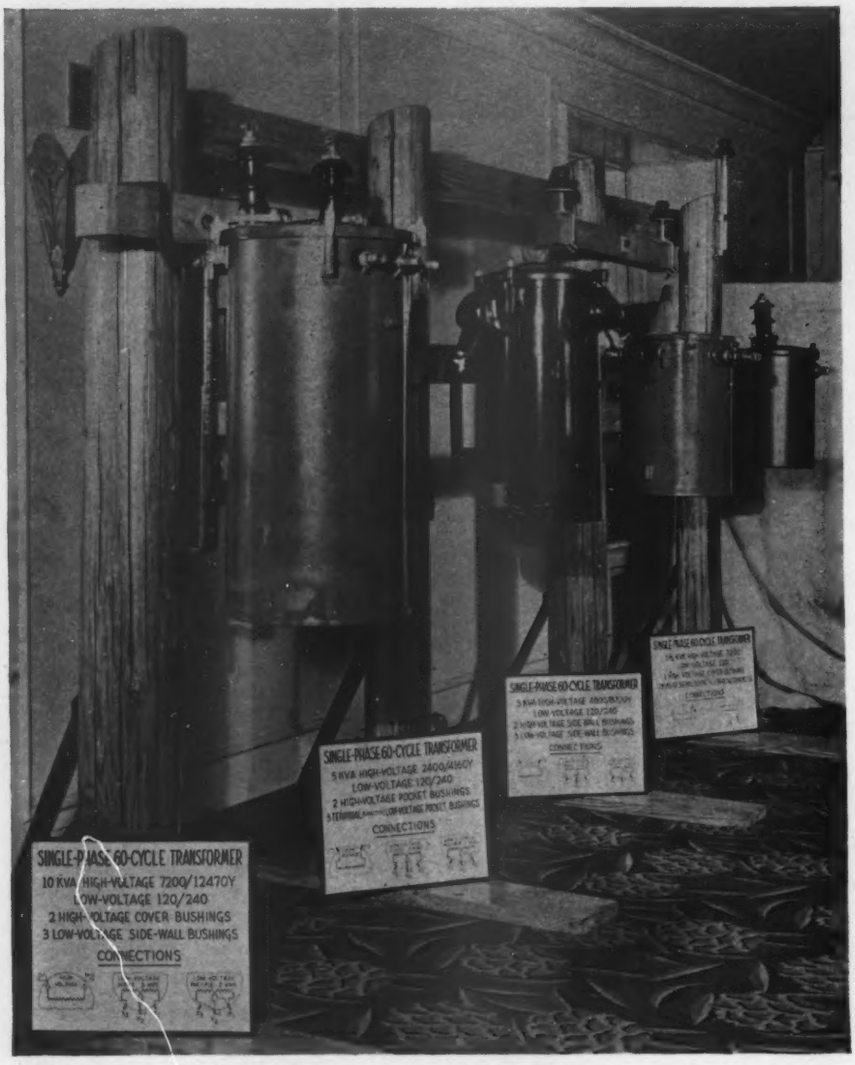


EXHIBIT of universal mounting for distribution transformers

Bushings

Perhaps more diversity has occurred in connection with bushings (location, type and number) than in any other aspect of the evolution of transformers. Here the joint committee, after surveying practices, determined that complete standardization would be impracticable at this time. Nevertheless considerable progress has been made in the standard just adopted. The stud type bushing is adopted in preference to the lead type and it will be equipped with solderless connectors. Several eliminations have been effected, but in general the matter of bushings is being left largely for subsequent orderly standardization as rapidly as is practicable. Such uniformity as has so far been incorporated has been established with primary regard for the location of low-voltage terminals because they involve the manipulation of much the heavier conductors.

The low-voltage bushing terminals are to be of a design to facilitate vertical risers either from above or from below. High-voltage bushings may be either cover, pocket or side-wall type, but they are to be disposed systematically and the low-voltage bushings are to be placed on the semi-circle away from the pole as shown on page 68.

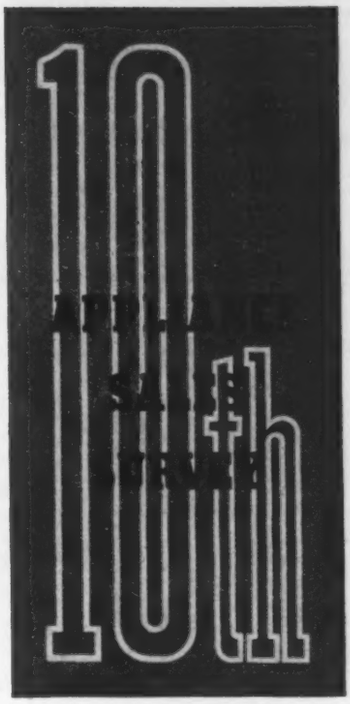
Ratings and Ratios

Capacity ratings for transformers of below 9,000 volts are to be 1½, 3, 5, 7½, 10, 15 and 25 kva.; from 9 to 15 kv. the ratings are to be 3, 5, 10, 15 and 25 kva.

Pending the availability of the findings of another E.E.I.-N.E.M.A. joint committee now engaged in reviewing preferred voltage ratings, the schedules being followed (with minor exception) are the "Preferred Voltage Ratings for A.C. Systems and Equipment," adopted by both N.E.M.A. and E.E.I. in 1930. Some questions have been encountered pertaining to ratios of the 7,200, 7,620, 12,000 and 13,200-volt group. The exception mentioned is that the 6,900-115/230

[*Continued on page 142*]

REVENUE BUILDING AND LOAD BUILDING IN 1939



Utility and dealer sales of household appliances and lighting resume upward trend — Increase of 14 per cent achieved with less money — Residential sales results analyzed for 65.3 per cent of the industry

By HENRY G. DOOLEY
Associate Editor

IN THE FIELD of residential sales, representing their greatest single source of revenue, utilities staged a speedy recovery in 1939, reporting an increase in combined company-dealer sales of 14 per cent over the previous year.

Two-thirds of the industry represented in this year's survey reported the expenditure of more than $118,000 per business day during 1939 to sell, promote and advertise small appliances, major appliances and lighting. These companies sold more major appliances onto their lines in 1939 as well as more lighting and minor appliances.

To complete the over-all picture, not only did utilities convert the minus signs of 1938 into plus signs of 1939 but they did it with an expenditure approximately 3.2 per cent *below* that of the previous year.

High Spots

This year operating companies representing 14,819,123 residential meters, or 65.3 per cent of the industry, supplied confidential data which make this survey and analysis possible. We regret that once again many reports were received too late for inclusion in the results.

Again this year we are observing a distinction between the companies (1) which both sell and promote lighting and appliances and (2) those which only promote lighting and appliances.

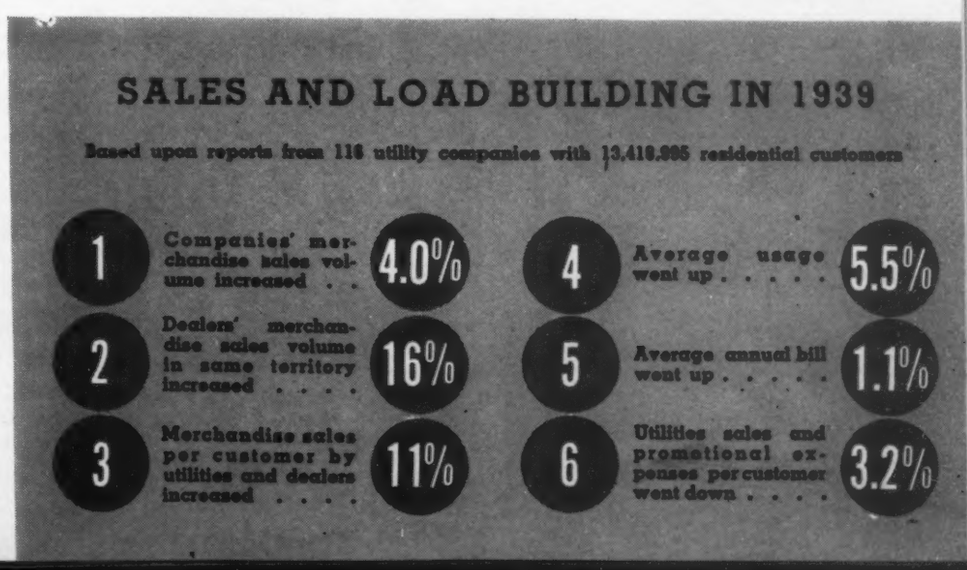
The first group of companies reports dealers' sales of $147,008,176 (Table I) and representatives reported that an average of 27.7 per cent of their dealer sales are in reality sales made by the utility company and turned over to the dealers. Only one of the companies in the second group (Table IV) reported on this aspect. It stated that it made 10 per cent of the sales and turned them over to local co-operating dealers, but of course reported them here as dealers' sales. The fact that 27.7 per cent of "dealers' sales" may in reality be utility sales should be kept in mind by the reader in applying the following to his own operations.

Subject to the above factors, the following high-spots, with respect to sales and promotion by the two groups of companies, appear from the record:

1. Combined utility and dealer sales of household lighting and appliances by the first group of companies amounted to $38.10 per residential customer in 1939. Sales of co-operating dealers of the group two companies amounted to $27.53 per residential customer in 1939.

2. From $38.10 of sales per customer the first group reports that it derived an estimated annual revenue of $3.38 per residential customer. From their dealers' sales of $27.53 per customer the second group of utilities reports that it derived an estimated annual revenue of $1.96 per residential customer.

3. We interrupt the sequence a moment to point out that to gain $1


SALES AND LOAD BUILDING IN 1939
Based upon reports from 116 utility companies with 13,419,995 residential customers
1
Companies' merchandise sales volume increased . . 4.0%
2
Dealers' merchandise sales volume in same territory increased 16%
3
Merchandise sales per customer by utilities and dealers increased 11%
4
Average usage went up 5.5%
5
Average annual bill went up 1.1%
6
Utilities sales and promotional expenses per customer went down 3.2%

Residential Appliance Sales and Promotion by Utilities

Table I—Total sales of household appliances by 116 power companies during the full year 1939, together with estimates of dealer sales of refrigerators, ranges and water heaters in the same areas.

Company	Domestic Consumers Dec. 31	Average Annual Domestic Kw.-Hr. Consumption		Av. Rev. per Consumer	Av. Price, Cents per Kw.-Hr.	REFRIGERATORS					RANGES					WATER HEATERS				
						Units Sold By Power Cos.		Units Sold By Dealers Pwr. Co. Est.		Saturation %	Units Sold By Power Cos.		Units Sold By Dealers Pwr. Co. Est.		Saturation %	Units Sold By Power Cos.		Units Sold By Dealers Pwr. Co. Est.		Saturation %
	1939	1939	1938	1939	1939	1939	1938	1939	1938	1939	1939	1938	1939	1938	1939	1939	1938	1939	1938	1939
I—NORTHEAST—North of the Ohio River, East of the Mississippi River																				
1	840,156	889	869	34.10	3.84	4,675	3,782	.....	.....	57	1,087	1,411	.....	.....	1	421	239	.....	.....	0
2	H 798,742	717	677	36.10	5.04	4,647	4,665	.....	.....	.....	201	243	.....	.....	.....	35	35	.....	.....	.....
3	594,069	1,025	974	35.11	3.42	2,423	1,844	.....	.....	57	6,437	6,650	5,880	6,142	14	1,190	655	102	77	0
4	H 585,010	1,025	959	36.97	3.61	7,147	3,347	52,800	39,579	61	2,019	3,326	2,582	2,801	7	1,598	3,040	997	731	4
5	H 546,992	635	612	34.07	5.37	6,388	6,077	.....	.....	.....	2,459	2,392	.....	.....	.....	148	143	.....	.....	.....
6	H 383,915	1,110	1,087	34.63	3.01	5,341	4,378	13,353	10,940	50	3,288	2,728	7,502	6,919	22	1,051	824	.....	4	.....
7	H 346,986	741	706	39.49	Q 5.19	2,400	2,226	19,759	15,505	52	1,312	1,524	3,611	2,315	8	296	371	456	327	2
8	H 310,044	968	940	38.79	4.01	.....	.....	.....	.....	59	.....	.....	.....	.....	1	.....	.....	.....	.....	.....
9	QH 286,603	Q 982	916	42.82	Q 4.36	1,972	1,811	16,014	13,121	65	1,020	1,302	1,695	1,292	4	725	674	504	282	1
10	228,518	894	842	33.41	3.74	.....	.....	11,441	12,874	49	2,688	3,239	2,234	2,219	14	873	841	492	567	4
11	H 224,984	874	831	42.25	4.84	407	622	8,587	7,464	60	283	341	745	895	8	238	251	271	291	3
12	H 224,403	963	912	29.81	3.10	714	742	18,000	16,195	74	309	454	472	326	R 16	130	132	62	56	R 3
13	217,241	1,060	1,004	31.87	3.00	825	1,150	11,175	8,050	41	737	950	2,343	1,700	9	158	600	1,017	300	3
14	178,958	1,167	1,092	36.76	3.15	2,474	1,841	4,500	2,400	55	1,704	1,403	2,120	1,650	17	441	450	301	224	4
15	H 148,268	1,047	977	42.86	4.10	2,876	2,485	3,500	3,000	58	1,354	1,351	475	425	13	733	780	220	180	3
16	H 122,988	707	655	34.31	4.84	1,240	1,398	1,750	2,796	50	702	738	120	75	15	237	250	25	.....	1
17	H 120,883	766	737	36.29	4.76	1,159	1,193	10,562	8,904	52	164	161	401	431	.....	88	119	186	118	.....
18	H 113,078	842	791	42.38	5.04	1,283	970	.....	.....	.....	125	101	.....	.....	.....	14	11	.....	.....	.....
19	111,297	957	877	35.42	3.70	668	582	.....	.....	.....	1,284	711	670	624	.....	317	639	171	124	.....
20	H 104,313	820	779	38.97	4.76	407	100	5,800	5,000	50	311	115	1,800	1,385	11	140	85	600	415	4
21	103,801	916	862	37.23	4.06	1,321	923	7,347	4,500	.....	721	462	1,571	1,444	.....	26	16	30	20	.....
22	H 93,279	835	776	37.33	4.47	.....	.....	7,544	5,480	56	292	437	305	301	5	116	118	57	24	8
23	QH 91,650	Q 852	Q 799	Q 42.22	4.95	980	972	4,138	2,437	33	692	865	444	367	13	295	325	191	145	7
24	90,632	.....	.....	.....	.....	.....	.....	.....	.....	.....	120	90	213	.....	3	.....	.....	.....	.....	.....
25	H 88,954	809	774	50.23	6.21	2,916	2,633	3,800	3,500	74	856	885	175	125	8	446	398	75	15	2
26	84,407	842	786	41.90	4.98	.....	.....	2,083	2,039	29	1,416	1,604	1,095	770	21	408	453	367	210	4
27	75,366	746	702	35.46	4.76	1,334	1,100	2,366	2,132	31	868	910	360	230	13	361	402	56	42	4
28	72,800	694	648	27.88	4.02	.....	.....	3,527	992	34	380	453	560	455	9	26	32	7	14	0
29	66,431	955	888	37.58	3.94	.....	.....	4,444	2,563	35	705	1,036	1,287	724	20	195	202	301	154	4
30	H 62,100	1,084	1,004	36.41	3.36	887	757	1,910	1,630	55	730	596	52	40	.....	201	194	7	5	.....
31	H 61,742	754	694	37.50	4.97	991	948	2,007	1,715	38	683	694	406	526	14	193	245	63	66	2
32	56,462	731	698	40.15	5.48	968	607	2,200	2,000	39	457	158	50	50	13	21	14	.....	.....	0
33	47,149	746	695	35.42	4.75	659	757	.....	.....	.....	536	588	.....	.....	.....	150	169	.....	.....	.....
34	H 45,882	903	854	43.65	4.82	299	54	1,500	1,600	48	253	92	400	500	19	145	63	50	100	4
35	H 45,661	538	507	32.63	6.07	685	468	1,184	836	42	81	60	43	34	3	15	13	.....	.....	0
36	44,832	970	916	36.16	3.73	982	885	1,320	1,268	52	495	392	256	215	10	139	110	28	39	2
37	42,575	991	935	38.88	3.92	.....	.....	3,115	2,038	51	810	596	726	535	20	289	163	211	153	6
38	41,620	809	760	39.44	4.80	587	601	2,073	1,893	75	155	89	134	177	11	57	9	5	.....	0
39	H 37,272	797	747	31.90	3.85	203	144	.....	.....	65	117	132	.....	.....	9	19	11	1	.....	.....
40	36,870	838	784	36.70	4.40	290	360	1,982	1,640	46	384	445	391	417	18	180	229	65	93	4
41	H 35,854	728	697	46.53	6.39	460	351	1,300	900	.....	77	107	60	60	.....	46	35	20	8	.....
42	H 34,886	806	772	31.84	3.95	389	296	1,163	1,026	44	308	294	142	90	7	89	83	14	9	1
43	H 33,875	570	545	47.62	5.70	279	183	500	400	40	80	43	81	50	1	2	0	1	1	.....
44	H 26,748	823	778	37.08	4.50	74	212	2,089	1,557	57	26	76	75	65	5	15	38	5	8	2
45	26,397	885	829	34.04	3.90	294	235	1,831	1,718	60	316	211	289	199	11	70	36	18	10	1
46	H 25,400	782	731	36.54	4.56	.....	.....	.....	.....	45	.....	.....	.....	.....	1	.....	.....	.....	.....	.....
47	H 24,279	855	802	33.82	3.96	447	337	2,600	2,000	86	40	56	12	15	.....	2	1	.....	.....	.....
48	21,179	964	859	34.84	3.61	9	10	.....	.....	.....	16	12	1,085	842	.....	15	.....	385	259	.....
49	14,165	747	704	37.05	4.96	220	119	1,060	640	56	19	18	3	2	1	.....	.....	.....	.....	.....
50	14,113	754	690	37.59	.....	111	100	550	446	.....	173	224	200	95	.....	71	78	42	14	.....
51	H 11,855	532	495	33.99	6.39	456	489	390	380	40	5	8	.....	.....	1	3	0	0	0	.....
52	9,832	848	768	P 45.34	5.35	232	194	.....	.....	35	144	119	.....	.....	16	66	2	.....	.....	9
53	89,632	936	876	43.59	4.66	3,925	3,606	2,000	1,600	68	1,660	1,485	500	340	7	52	43	.....	.....	1
54	H 62,284	814	737	35.95	4.41	862	1,089	2,382	.....	34	493	677	265	249	10	451	534	83	110	4
55	17,096	709	659	35.92	5.00	344	303	834	699	41	172	169	90	139	14	43	59	14	8	4
56	H 34,797	977	924	44.33	4.54	.....	443	2,500	2,200	60	.....	85	100	70	6	.....	13	40	4	.....
Total..	8,254,225	Y 849	Y 792	Y 37.66	Y 4.48	68,250	58,389	248,980	197,657	Y 51	41,764	43,308	44,020	38,325	Y 10	13,040	14,227	7,540	5,207	Y 2.8
II—SOUTHEAST—South of Ohio River, East of Mississippi River																				
60	H 247,907	838	816	33.49	4.00	1,464	2,260	.....	.....	.....	242	325	.....	.....	.....	105	139	.....	.....	.....
61	179,331	1,446	1,399	41.02	2.84	3,528	4,058	11,885	10,996	68	3,154	2,480	1,531	1,187	23	2,264	1,670	613	466	23
62	149,689	887	862	34.06	3.84	.....	.....	6,500	6,966	53	1,655	1,550	1,594	1,527	12	330	366	242	235	2
63	133,738	1,165	1,141	42.50	3.65	.....	.....	10,305	12,123	72	767	886	1,023	754	15	177	236	81	55	4
64	123,597	1,286	1,262	38.34	2.98	826	830	10,678	8,612	65	1,229	1,180	1,804	2,125	23	665	652	606	709	9
65	H 93,925	643	588	31.31	4.91	656	746	5,828	3,943	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
66	90,669	1,279	1,200	39.44	3.08	246	554	11,111	9,023	71	654	1,012	3,434	2,456	24	418	419	1,160	770	8
67	78,126	731	699	36.15	4.90	1,059	806	5,180	4,060	.....	564	659	573	523	.....	210	268	145	116	.....
68	63,916	837	795	40.31	4.81	2,505	1,893	.....	.....	.....	997	957	.....	.....	.....	287	244	.....	.....	.....
69	H 40,502	808	771	36.49	4.50	115	219	4,405	3,729	.....	109	96	511	405	.....	29	39	141	100	.....
70	36,314	778	718	P 40.19	5.17	927	546	941	739	43	973	707	161	102	16	401	334	161	102	16
71	29,249	1,082	1,033	50.51	4.60	100	101	2,144	1,790	50	350	294	604	409	20	428	357	568	465	21
72	28,740	954	902	36.11	3.78	952	706	.....	.....	49	276	338	44	42	11	109	165	19	23	5
73	28,631	894	857	34.65	3.88	.....	.....	1,414	1,080	52	232	215	74	45	6	232	215	74	45	6
74	28,584	769	727	43.05	5.60	353	283	965	996	50	176	95	178	127	12	51	35	23	29	2

* Estimated. A Outside salesmen only. C At net prices. D District representative plan. E Ranges and water heaters only.
F Excludes home lighting personnel. H Company has gas customers. I Combined with gas expenses. J Includes dealers' sales. L Advertising budget only.

and their Local Dealers for the Full Year 1939

Also, comparisons of these sales totals with the year 1938, with data on average consumption, rates, revenues, saturations, sales totals, sales people and direct sales and promotional expense in building residential load—embracing nearly fourteen million consumers.

Washing Machines Units Sold By Power Cos.		Saturation Washing Machines, %	Ironing Machines Units Sold By Power Cos.		Saturation Ironing Machines, %	Vacuum Cleaners Units Sold By Power Cos.		Saturation Vacuum Cleaners, %	Total Sales of All Appliances By Power Cos. (Dollars)		Total Sales of All Appliances By Dealers (Dollars)		Power Co. Sales Per Consumer($)	Annual Rev. Inc. from Power Co. Sales (Dollars)	No. Power Co. Salesmen and Women Building Domestic Load		Consumers Per Sales Person	Power Co. Direct Sales Expense ($)	Power Co. Advtg. & Promotion Exp. ($)	Sales & Adv. Exp. Per Consumer($)	Company
1939	1938	1939	1939	1938	1939	1939	1938	1939	1939	1938	1939	1938	1939	1939	1939	1938	1939	1939	1939	1939	
I—NORTHEAST—North of the Ohio River, East of the Mississippi River																					
3,199	3,027	55	704	567	7	5,426	6,238	70	O 3,903,256	O 3,792,050	.....	.....	4.65	.....	603	582	1,393	.....	.....	.....	1
7,270	6,676	.....	1,631	1,221	.....	5,460	4,295	.....	2,702,455	2,701,653	.....	.....	3.38	.....	291	351	2,742	.....	.....	.....	2
		.....	302	196	.....	.....	.....	.....	C 1,617,943	C 1,350,281	.....	.....	2.72	.....	78	65	7,490	.....	531,847	.....	3
2,010	1,837	.....	378	369	.....	1,001	814	.....	2,744,742	2,424,337	.....	.....	4.69	309,240	P 276	P 271	P 2,120	.....	.....	.....	4
3,689	3,713	.....	592	621	.....	3,375	3,134	.....	2,357,000	2,221,000	.....	.....	4.30	608,099	240	195	2,280	.....	.....	.....	5
2,266	1,763	.....	867	761	.....	2,325	1,607	.....	1,983,970	1,913,244	.....	.....	5.18	.....	417	399	918	.....	.....	.....	6
2,178	1,741	89	300	250	1	2,457	1,441	64	1,096,024	1,024,274	10,700,809	8,608,319	3.16	116,651	356	345	972	456,568	365,718	2.37	7
		85	.....	.....	14	.....	.....	70	.....	.....	.....	.....	.....	.....	27	.....	.....	68,112	198,000	0.86	8
1,373	1,385	76	402	418	10	1,354	1,409	86	1,142,773	1,105,525	.....	.....	4.07	.....	122	148	2,300	.....	.....	.....	9
.....	.....	.....	.....	.....	.....	.....	.....	.....	402,559	431,794	.....	.....	1.76	T 131,688	72	72	3,170	.....	L 69,639	.....	10
.....	.....	.....	.....	.....	.....	.....	.....	.....	140,723	189,033	.....	.....	0.63	22,700	.....	.....	.....	.....	.....	.....	11
798	604	65	403	126	6	1,433	1,197	58	634,436	635,358	9,000,000	7,000,000	2.82	36,000	.....	92	.....	.....	.....	.....	12
616	642	80	63	58	6	1,319	1,068	80	704,913	753,607	.....	.....	3.29	.....	75	75	2,900	.....	.....	.....	13
1,417	1,266	.....	752	633	.....	771	794	.....	1,167,490	1,127,826	.....	.....	6.52	.....	203	191	880	.....	.....	.....	14
995	689	78	288	265	5	993	663	80	1,007,550	914,820	.....	.....	8.75	.....	128	136	1,152	201,852	L 59,377	1.76	15
337	627	75	135	132	1	219	671	70	527,671	603,547	823,000	802,150	4.29	92,399	94	87	1,308	.....	.....	.....	16
216	240	.....	39	38	.....	31	49	.....	291,885	309,764	.....	.....	2.42	.....	55	55	2,190	67,082	94,268	1.34	17
344	454	.....	97	186	.....	106	.....	.....	319,160	283,709	.....	.....	2.82	.....	26	26	4,350	.....	(I)	(I)	18
169	245	.....	35	51	.....	502	751	.....	510,279	394,132	.....	.....	4.59	88,307	50	40	2,222	.....	.....	.....	19
97	30	55	21	15	.....	.....	.....	.....	125,670	72,767	.....	1,607,100	1.20	31,598	14	10	7,460	49,500	49,200	0.95	20
249	204	.....	108	123	.....	173	205	.....	598,545	514,115	.....	.....	5.77	.....	109	102	950	.....	.....	.....	21
.....	.....	60	.....	.....	8	.....	.....	63	R 42,185	R 69,210	2,574,506	2,124,170	R 0.45	12,240	26	28	3,580	6,650	37,750	0.48	22
540	482	.....	112	141	.....	.....	401	.....	553,953	608,117	2,900,000	2,400,000	6.03	.....	56	50	1,640	119,800	35,838	1.70	23
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	5	.....	.....	.....	.....	24
858	681	51	257	330	4	981	679	72	912,520	858,299	.....	.....	10.28	305,019	50	49	1,780	.....	(I)	(I)	25
.....	.....	.....	.....	.....	.....	.....	.....	.....	162,133	177,256	.....	.....	1.93	T 67,296	26	.....	3,240	.....	L 31,306	.....	26
1,152	832	.....	166	159	.....	438	536	.....	696,936	628,062	.....	.....	9.26	.....	28	28	2,690	49,681	23,623	0.97	27
.....	.....	.....	.....	.....	.....	.....	.....	.....	62,559	57,763	.....	.....	0.86	T 14,720	17	17	4,290	.....	L 18,937	.....	28
.....	.....	.....	.....	.....	.....	.....	.....	.....	119,321	146,959	.....	.....	1.83	T 33,180	20	20	3,321	.....	L 31,428	.....	29
772	641	.....	101	115	.....	462	452	.....	475,717	444,384	.....	.....	.....	.....	F 31	F 31	F 2,000	.....	.....	.....	30
931	852	.....	205	307	.....	.....	.....	.....	465,107	482,187	.....	.....	7.55	.....	37	34	1,670	151,472	40,845	3.12	31
.....	.....	50	54	39	0	.....	.....	57	154,535	67,076	.....	.....	2.74	65,759	12	11	4,700	.....	6,262	.....	32
660	518	.....	112	109	.....	480	496	.....	445,302	443,844	.....	.....	9.45	.....	34	33	1,388	99,750	22,693	2.59	33
48	28	.....	5	2	.....	122	.....	.....	116,000	35,000	700,000	750,000	2.54	20,000	10	4	4,588	14,000	3,500	0.38	34
184	75	65	61	39	3	50	100	60	D 239,700	D 185,952	200,000	125,000	.....	52,000	D 55	D 55	D 2,283	.....	.....	.....	35
591	563	.....	245	251	.....	328	221	.....	384,022	388,326	.....	.....	8.57	.....	32	58	1,400	.....	.....	.....	36
.....	.....	.....	.....	.....	.....	.....	.....	.....	125,299	89,747	.....	.....	2.94	T 40,720	19	19	2,240	.....	L 21,612	.....	37
105	69	65	18	11	0	120	204	50	191,809	177,426	717,315	467,120	4.60	30,008	18	18	2,318	64,324	16,589	1.94	38
.....	.....	.....	.....	.....	.....	.....	.....	.....	113,467	104,782	.....	.....	3.04	17,737	8	8	4,660	.....	.....	.....	39
0	13	.....	0	3	.....	147	212	.....	219,354	224,683	.....	.....	5.94	58,800	20	20	1,843	21,526	132,607	4.19	40
254	187	.....	72	63	.....	167	186	.....	159,378	139,948	.....	.....	4.44	28,000	25	25	1,435	80,384	55,798	3.80	41
257	198	.....	54	31	.....	200	179	.....	188,710	159,090	.....	.....	5.40	.....	30	33	1,162	.....	.....	.....	42
319	348	80	12	16	1	435	458	70	155,172	125,653	.....	.....	4.59	.....	10	10	3,387	29,107	9,438	1.14	43
5	3	70	.....	.....	7	.....	.....	90	18,560	53,459	457,760	383,400	0.70	T 2,982	5	5	5,349	O 42,044	.....	.....	44
.....	.....	.....	.....	.....	.....	.....	.....	.....	123,400	100,468	.....	.....	4.69	58,253	13	13	2,030	.....	.....	.....	45
136	185	85	45	33	5	123	173	60	70,000	72,150	.....	.....	2.76	.....	6	4	4,240	5,916	22,571	1.12	46
342	269	92	33	18	4	442	373	91	368,270	274,554	.....	.....	15.20	.....	14	14	1,735	(M)	.....	.....	47
0	5	.....	1	2	.....	4	4	.....	.....	.....	.....	.....	.....	.....	21	21	1,000	1,175	104,432	4.99	48
.....	.....	.....	44	35	13	.....	.....	.....	65,396	42,192	.....	.....	4.47	31,863	4	3	3,541	3,000	8,000	0.78	49
74	55	.....	16	17	.....	11	.....	.....	78,570	78,350	.....	.....	5.56	10,678	9	10	1,568	13,200	12,000	1.78	50
228	208	75	33	21	15	151	117	90	124,582	127,051	93,437	95,289	10.50	50,000	9	9	1,317	42,536	8,700	4.33	51
79	67	75	5	4	3	72	45	60	85,526	67,948	.....	.....	8.70	.....	7	7	1,404	.....	.....	1.94	52
1,012	651	60	200	221	5	1,615	711	55	1,677,620	1,320,194	2,000,000	1,000,000	18.70	.....	200	190	448	(M)	82,709	M 0.92	53
248	310	72	55	63	4	627	909	57	327,000	416,000	.....	.....	5.25	75,000	83	71	750	.....	.....	.....	54
280	278	.....	32	72	.....	.....	.....	.....	156,985	147,324	.....	.....	9.19	.....	10	10	1,710	35,160	7,341	2.49	55
.....	556	62	.....	104	13	.....	549	58	365,698	334,839	940,000	850,000	10.50	51,378	26	26	1,338	.....	.....	.....	56
36,298	37,217	Y 70	9,055	8,236	Y 6	33,920	30,841	Y 69	33,423,830	31,411,129	31,106,827	26,212,548	Y 5.30	2,462,315	4,182	4,181	Y 2,478	1,622,839	2,102,028	Y 2.05	Total
II—SOUTHEAST—South of Ohio River, East of Mississippi River																					
1,793	1,982	.....	124	139	.....	2,288	1,887	.....	1,048,566	1,306,731	.....	.....	4.23	131,000	209	228	1,182	(I)	(I)	.....	60
1,027	834	35	139	149	.....	562	803	65	1,599,186	1,511,035	2,000,000	.....	8.91	249,871	120	135	1,500	.....	815,998	.....	61
.....	.....	.....	.....	.....	.....	.....	.....	.....	226,731	236,088	.....	.....	1.51	T 72,780	42	42	3,560	.....	L 36,619	.....	62
130	96	.....	11	11	.....	392	146	.....	.....	.....	.....	.....	.....	T 34,000	10	32	.....	.....	.....	.....	63
729	595	.....	89	70	.....	238	259	.....	620,725	638,622	.....	.....	5.04	.....	27	38	4,570	.....	.....	.....	64
566	623	.....	35	26	.....	231	264	.....	373,286	408,102	3,393,679	2,701,000	3.97	107,343	69	64	1,360	.....	.....	.....	65
10	2	.....	.....	.....	.....	9	33	.....	471,406	485,321	4,611,562	3,899,586	5.19	83,959	58	53	1,562	.....	.....	.....	66
692	.....	.....	.....	.....	.....	.....	.....	.....	531,476	474,475	.....	.....	6.80	.....	50	63	1,562	.....	.....	.....	67
1,041	963	.....	79	.....	.....	.....	.....	.....	1,037,716	913,908	.....	.....	16.20	.....	54	55	1,181	.....	.....	.....	68
60	66	.....	122	105	.....	147	233	.....	166,195	146,994	1,862,955	1,812,583	4.10	19,201	40	33	1,012	.....	.....	.....	69
52	68	.....	27	29	.....	122	156	.....	335,118	267,218	.....	.....	9.22	96,783	20	20	1,815	90,067	81,397	4.73	70
6	0	20	7	10	.....	60	97	.....	167,872	158,000	1,015,000	850,000	5.72	40,000	12	12	2,440	43,977	12,538	1.93	71
166	66	.....	0	0	0	0	0	8	246,527	259,209	.....	.....	8.58	.....	12	11	2,395	.....	.....	.....	72
.....	.....	.....	16	15	.....	64	18	.....	44,843	40,348	.....	.....	1.56	T 11,232	9	9	3,170	.....	L 6,259	.....	73
55	43	48	3	2	.....	84	67	49	J 115,676	J 91,801	.....	.....	4.04	64,989	12	10	2,291	9,457	7,873	0.61	74

M Appliance profit covers expenses.
T Major appliances only.
O Includes commercial.
Y Straight line average.
P Decrease due to rate reduction.
Q Including rural.
R Territory beyond company gas mains.

Residential Appliance Sales and Promotion by Utilities

Table I—Total sales of household appliances by 116 power companies during the full year 1939, together with estimates of dealer sales of refrigerators, ranges and water heaters in the same areas.

Company	Domestic Consumers Dec. 31	Average Annual Domestic Kw.-Hr. Consumption		Av. Rev. per Consumer	Av. Price, Cents per Kw.-Hr.	REFRIGERATORS					RANGES					WATER HEATERS				
						Units Sold By Power Cos.		Units Sold By Dealers Pwr. Co. Est.		Saturation %	Units Sold By Power Cos.		Units Sold By Dealers Pwr. Co. Est.		Saturation %	Units Sold By Power Cos.		Units Sold By Dealers Pwr. Co. Est.		Saturation %
	1939	1939	1938	1939	1939	1939	1938	1939	1938	1939	1939	1938	1939	1938	1939	1939	1938	1939	1938	1939
II—SOUTHEAST—South of Ohio River, East of Mississippi River—(Concluded)																				
75	[H] 23,882	1,413	1,326	45.10	3.19	519	273	750	600	55	396	224	180	150	20	220	143	75	50	9
76	[H] 22,490	670	678	33.76	5.00	8	33	1,226	1,599	51	3	10	93	248	7	.....	1	5	16	.....
77	22,136	746	723	30.53	4.09	.....	.....	1,236	757	52	229	179	98	72	8	30	31	15	13	1
78	[H] 15,115	1,259	1,226	45.00	3.57	238	197	.....	.....	.....	216	178	.....	.....	.....	112	76	.....	.....	.....
79	[H] 13,240	1,242	1,180	54.29	4.36	196	123	798	704	81	129	76	313	258	30	71	79	185	151	16
80	5,541	1,100	1,032	35.06	3.19	.....	.....	625	408	64	143	103	190	149	30	37	21	41	33	6
81	68,076	859	820	27.73	3.23	.....	.....	6,710	5,091	.....	.....	.....	962	827	.....	.....	.....	110	102	.....
82	[H] 110,805	1,216	1,156	[P] 48.68	4.00	392	207	14,099	14,916	60	1,197	558	5,045	5,034	22	489	326	2,041	2,518	13.1
83	[H] 91,091	721	713	35.63	4.94	1,765	1,307	5,300	3,793	56	247	199	60	60	2	15	19	0	0	.....
Total..	1,725,294	[Y] 984	[Y] 943	[Y] 38.89	[Y] 4.09	15,849	15,142	102,100	91,925	[Y] 58	13,938	12,321	18,472	16,500	[Y] 17	6,680	5,835	6,305	5,996	[Y] 9
III—CENTRAL—West of Mississippi River, East of Rocky Mountains																				
87	[H] 331,753	1,112	1,014	37.65	3.39	3,853	3,622	24,300	18,000	52	2,743	2,961	3,477	2,965	14	2,100	1,971	1,802	1,645	6
88	[H] 307,563	1,015	976	32.74	3.23	1,193	1,152	21,083	22,534	80	1,313	1,548	2,938	2,842	8	.....	.....	.....	.....	.....
89	129,694	980	930	38.57	3.94	2,078	1,350	.....	.....	.....	1,735	1,174	.....	.....	.....	332	175	.....	.....	.....
90	125,518	864	836	33.45	3.87	1,001	1,125	12,620	11,787	70	29	36	49	57	1	11	9	4	5	2
92	99,044	683	652	35.31	3.18	116	898	12,033	10,828	40	328	291	497	311	6	38	35	98	38	.....
93	72,782	971	928	38.08	3.92	226	191	6,576	6,512	70	308	110	351	233	6	164	94	113	98	.....
94	[H] 71,259	1,014	987	42.80	4.22	1,465	1,384	5,028	5,468	58	881	1,043	206	233	11	498	576	53	27	5
95	60,330	749	723	[P] 39.00	5.21	68	268	6,845	6,100	.....	42	108	227	161	.....	20	25	39	52	.....
96	51,277	878	857	45.91	5.23	1,411	1,342	3,618	4,030	55	525	559	130	134	12	220	169	38	32	4
97	41,128	920	863	37.22	4.05	348	223	1,993	1,621	33	456	443	395	377	17	153	161	93	71	4
98	[H] 38,282	872	809	41.28	4.76	658	533	1,852	1,748	41	784	544	290	254	16	338	162	35	36	3
99	38,079	990	946	46.41	4.69	1,909	1,542	1,402	1,547	.....	504	672	43	44	.....	318	383	8	12	.....
100	28,822	.....	.....	.....	.....	627	384	.....	.....	29	413	510	.....	.....	24	197	259	.....	.....	4
101	[H] 23,867	765	736	37.91	4.95	373	289	1,392	1,541	58	231	258	63	91	10	24	32	13	9	1
102	21,442	1,128	1,082	39.74	3.52	506	395	1,173	1,066	66	282	293	33	34	19	292	300	26	13	12
103	[H] 19,116	787	753	34.43	4.38	2	13	2,161	1,904	46	.....	3	8	.....	.....	.....	.....	.....	2	.....
104	19,033	823	772	41.73	5.07	405	415	525	389	48	276	266	69	36	15	52	36	8	2	1
106	[H] 16,528	726	693	31.56	4.35	.....	2	1,594	1,390	80	.....	.....	45	65	10	0	0	9	15	5
107	[H] 14,464	609	584	35.12	5.80	418	273	747	436	48	176	144	57	47	12	57	43	19	6	4
108	10,837	835	778	41.17	4.93	109	83	654	490	59	184	137	93	74	16	69	67	43	24	6
109	[H] 6,623	709	643	35.01	4.90	182	199	150	134	35	7	9	12	10	.....	1	3	4	0	.....
110	[H] 3,354	1,032	949	42.60	3.71	77	36	200	150	60	97	117	8	5	28	41	40	3	.....	5
111	63,265	836	801	40.16	4.80	1,412	1,430	5,051	4,923	59	294	492	31	56	5	106	190	3	4	.....
Total..	1,594,060	[Y] 877	[Y] 832	[Y] 38.54	[Y] 4.37	18,437	17,149	110,997	102,598	[Y] 54	11,608	11,718	9,022	8,029	[Y] 13	5,031	4,730	2,411	2,091	[Y] 4
IV—WESTERN—Rocky Mountains to Pacific Coast																				
122	434,320	977	946	36.32	3.72	.....	.....	35,893	33,052	*57	1,798	1,309	2,925	3,811	*10	640	405	804	1,125	*4
123	[Q] 172,207	1,317	1,256	35.07	2.66	553	394	10,063	8,150	37	1,546	1,597	2,852	1,703	28	1,598	895	973	657	12
124	[H] 112,059	701	643	34.10	4.90	1,579	1,211	.....	.....	50	591	398	.....	.....	2	109	30	.....	.....	.....
125	104,346	1,116	1,044	38.87	3.48	773	642	8,671	6,830	60	1,158	1,080	2,335	1,862	38	661	516	329	299	6
126	[H] 77,346	954	897	32.24	3.38	398	273	7,727	7,402	68	207	280	338	308	7	229	326	276	249	5
127	[H] 70,426	875	839	37.92	4.33	438	585	5,760	4,793	.....	465	450	828	622	20	79	91	92	108	.....
128	[H] 67,143	2,060	1,985	44.81	2.17	229	118	7,244	6,390	45	758	721	1,852	1,535	35	1,385	826	1,047	765	25
129	52,683	1,855	1,719	49.41	2.66	579	585	4,262	3,520	.....	1,330	1,748	2,220	2,727	55	1,006	1,485	677	618	24
130	21,777	891	838	40.57	4.55	328	327	1,652	1,382	32	335	296	118	84	20	119	150	33	23	5
131	[H] 687,747	985	945	33.19	3.37	.....	.....	53,672	46,993	.....	.....	.....	3,996	4,177	.....	.....	.....	2,189	2,145	.....
132	45,362	1,606	1,550	40.78	2.54	520	457	5,533	4,855	41	798	890	1,163	803	22	531	475	750	578	16
Total..	1,845,416	[Y] 1,212	[Y] 1,151	[Y] 38.48	[Y] 3.43	5,397	4,592	140,477	123,367	[Y] 49	8,986	8,769	18,627	17,632	[Y] 24	6,357	5,199	7,170	6,567	[Y] 12

*Estimated. [A] Outside salesmen only. [C] At net prices. [D] District representative plan. [E] Ranges and water heaters only.
[F] Excludes home lighting personnel. [H] Company has gas customers. [I] Combined with gas expenses. [J] Includes dealers' sales. [L] Advertising budget only.

Table II—Regional Summary and Comparison of

Some general reflections of local conditions and the sales activity of the power companies in the four major areas of the country.

Region	Total Domestic Consumers Dec. 31, 1939	Av. Dom. Kw.-Hr. Consumption 1939	Kw.-Hr. Increase Over Dec. 31, 1938	Av. Cost of Dom. Service Cents per Kw.-Hr. 1939	Av. Revenue per Consumer 1939	Refrigerators Units Sold by Power Cos. 1939	Ranges Units Sold by Power Cos. 1939	Water Heaters Units Sold by Power Cos. 1939	Washing Machines Units Sold by Power Cos. 1939	Ironing Machines Units Sold by Power Cos. 1939	Vacuum Cleaners Units Sold by Power Cos. 1939	Refrigerators Sold per 1,000 Consumers 1939	Ranges Sold per 1,000 Consumers 1939	Water Heaters Sold per 1,000 Consumers 1939	Washing Machines Sold per 1,000 Consumers 1939
Northeast	**8,254,225**	**849**	**57**	**4.48**	**37.66**	**68,250**	**41,764**	**13,040**	**36,298**	**9,055**	**33,920**	**9**	**5**	**2**	**6**
Southeast	**1,725,294**	**984**	**41**	**4.09**	**38.89**	**15,849**	**17,938**	**6,680**	**7,751**	**914**	**4,922**	**12**	**10**	**4**	**4**
Central	**1,594,060**	**877**	**45**	**4.37**	**38.54**	**18,437**	**11,608**	**5,031**	**3,986**	**671**	**4,347**	**12**	**7**	**4**	**3**
Western	**1,845,416**	**1,212**	**61**	**3.43**	**38.48**	**5,397**	**8,986**	**6,357**	**2,451**	**551**	**2,225**	**7**	**8**	**5**	**5**
Nat'l Total or Average	**13,418,995**	**980**	**51**	**4.09**	**38.39**	**107,933**	**76,296**	**31,108**	**50,486**	**11,191**	**45,414**	**10**	**7.5**	**4**	**4.5**

and their Local Dealers for the Full Year 1939

Also, comparisons of these sales totals with the year 1938, with data on average consumption, rates, revenues, saturations, sales totals, sales people and direct sales and promotional expense in building residential load—embracing nearly fourteen million consumers.

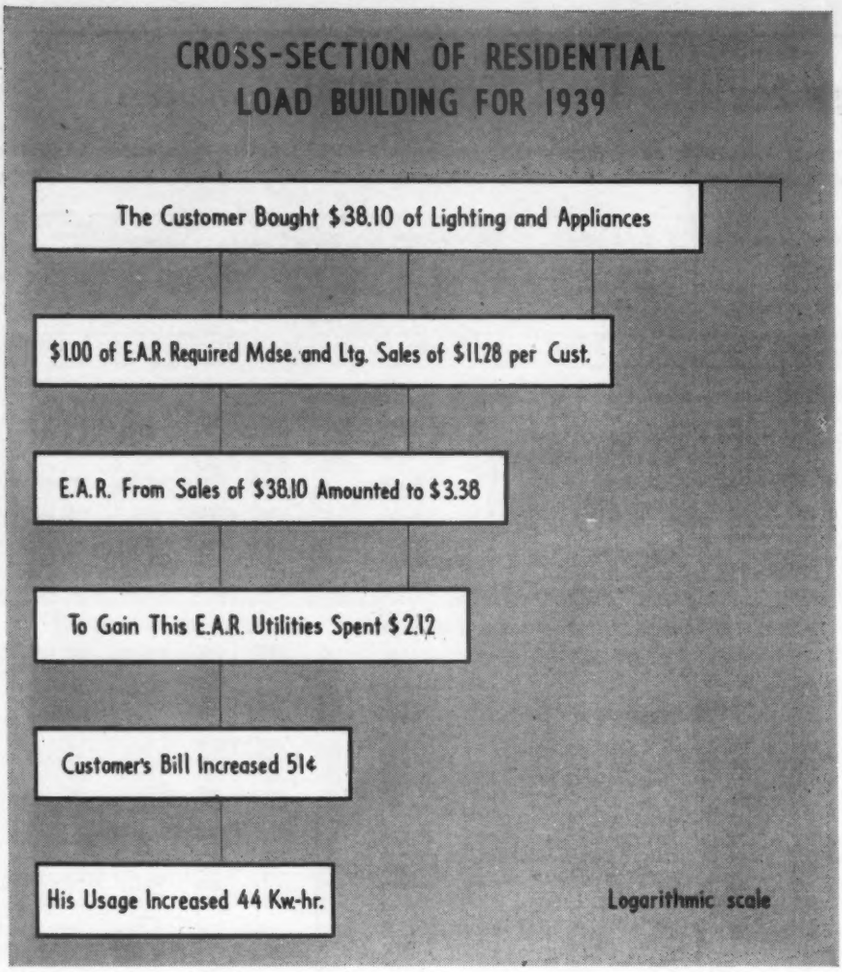
Washing Machines Units Sold By Power Cos.		Saturation Washing Machines, %	Ironing Machines Units Sold By Power Cos.		Saturation Ironing Machines, %	Vacuum Cleaners Units Sold By Power Cos.		Saturation Vacuum Cleaners, %	Total Sales of All Appliances By Power Cos. (Dollars)		Total Sales of All Appliances By Dealers (Dollars)		Power Co. Sales Per Consumer($)	Annual Rev. Inc. from Power Co. Sales (Dollars)	No. Power Co. Salesmen and Women Building Domestic Load		Consumers Per Sales Person	Power Co. Direct Sales Expense ($)	Power Co. Advtg. & Promotion Exp. ($)	Sales & Adv. Exp. Per Consumer($)	Company
1939	1938	1939	1939	1938	1939	1939	1938	1939	1939	1938	1939	1938	1939	1939	1939	1938	1939	1939	1939	1939	
II—SOUTHEAST—South of Ohio River, East of Mississippi River—(Concluded)																					
157	106	.....	14	15	.....	100	138	.....	201,757	151,248	.....	.....	8.41	.....	15	11	1,591	.....	.....	.....	75
.....	.....	.....	2	.....	.....	.....	.....	.....	26,549	35,067	275,000	375,000	1.18	304	.....	3	.....	3,000	500	.....	76
.....	.....	.....	.....	.....	.....	.....	.....	.....	36,718	31,516	.....	.....	1.66	T 9,444	7	7	3,160	.....	L 6,500	.....	77
95	87	.....	22	10	.....	45	65	.....	117,514	114,764	.....	.....	7.76	.....	P 10	P 10	1,511	.....	.....	.....	78
16	18	.....	0	2	.....	30	21	.....	76,488	53,097	229,160	198,411	5.76	8,489	15	14	889	*60,000	*10,000	5.29	79
.....	.....	.....	.....	.....	.....	.....	.....	.....	22,659	15,836	.....	.....	4.10	T 6,628	2	2	2,770	.....	L 2,330	.....	80
.....	.....	.....	.....	.....	.....	.....	.....	.....	137,691	202,431	3,794,913	2,844,434	2.02	.....	.....	.....	.....	.....	.....	.....	81
163	107	.....	23	19	.....	294	150	.....	364,379	264,896	6,500,515	7,418,527	3.29	70,128	60	52	1,846	179,441	197,368	3.40	82
993	871	62	201	196	3	256	353	62.2	778,756	511,824	1,947,000	1,680,000	8.53	89,693	98	101	930	124,405	67,409	2.11	83
7,751	7,527	Y 41	914	798	Y 3	4,922	5,690	Y 46	8,747,834	8,318,531	25,629,784	21,779,541	Y 5.56	1,095,844	941	1,005	Y 2,014	510,347	1,244,791	Y 3.01	Total
III—CENTRAL—West of Mississippi River, East of Rocky Mountains																					
560	616	75	176	235	13	1,540	1,496	73	1,535,000	1,585,000	9,900,000	8,900,000	4.63	235,000	192	212	1,725	390,000	310,000	2.12	87
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	115	113	2,670	.....	.....	.....	88
534	917	.....	74	65	.....	559	398	.....	1,227,239	968,185	.....	.....	9.46	184,423	.....	.....	.....	.....	.....	.....	89
36	27	28	6	.....	2	697	767	28	537,862	575,894	5,981,631	4,439,950	4.28	50,630	70	70	1,800	.....	.....	.....	90
65	194	.....	31	.....	.....	40	79	.....	255,709	406,825	4,436,574	3,041,407	2.57	42,535	89	91	1,110	116,341	197,933	3.18	92
98	113	.....	34	54	.....	127	162	.....	207,846	151,851	3,261,417	3,004,907	2.85	37,417	.....	57	1,052	.....	.....	.....	93
153	56	.....	10	1	.....	137	68	.....	657,311	651,443	.....	.....	9.23	114,779	83	75	859	165,036	79,503	3.43	94
12	90	.....	0	0	.....	46	75	.....	143,242	187,834	3,349,056	2,926,336	2.38	28,429	38	45	1,588	31,329	178,830	3.49	95
485	488	.....	72	97	.....	120	169	.....	.....	.....	.....	.....	14.07	57,528	40	40	1,282	253,433	38,741	5.70	96
190	231	80	76	51	6	230	209	65	230,025	197,146	.....	.....	5.60	46,067	41	40	1,000	.....	147,097	.....	97
215	238	72	32	37	2	162	175	75	417,988	378,153	950,000	900,000	10.91	43,473	36	34	1,062	.....	10,799	.....	98
454	407	.....	29	56	.....	181	189	.....	862,147	844,080	.....	.....	22.64	164,498	47	46	811	.....	.....	.....	99
8	18	.....	2	5	.....	8	28	.....	.....	.....	.....	.....	.....	157,563	6	6	4,804	.....	.....	.....	100
160	128	80	17	35	4	70	42	.....	183,782	159,175	.....	.....	7.69	44,698	18	21	1,328	37,155	39,569	3.21	101
60	66	22	15	28	4	70	61	46	252,765	228,618	.....	.....	11.78	.....	15	13	1,430	36,462	22,748	2.76	102
9	8	80	0	1	3	6	14	72	16,143	20,710	.....	.....	0.84	.....	4	4	4,779	7,200	25,531	1.71	103
12	135	.....	18	20	.....	123	134	.....	172,822	167,845	.....	.....	9.08	35,077	9	9	2,115	53,270	9,395	3.29	104
0	1	60	0	0	30	0	0	70	3,600	3,700	600,000	510,000	0.22	.....	2	.....	8,264	5,500	16,425	1.32	106
304	171	55	20	19	3	.....	.....	.....	172,262	108,800	.....	.....	11.90	27,021	10	8	1,446	22,893	5,809	1.98	107
28	12	.....	6	3	.....	.....	.....	.....	82,356	77,580	.....	.....	7.58	9,961	7	8	1,548	23,140	6,197	2.70	108
79	75	85	7	6	10	70	97	70	72,845	84,010	.....	.....	11.00	21,245	10	10	662	8,727	19,000	4.18	109
.....	.....	.....	.....	.....	.....	.....	.....	.....	42,877	40,987	.....	.....	12.80	.....	3	3	1,118	13,273	6,241	5.82	110
524	682	30	46	76	1	161	180	68	504,188	515,871	.....	.....	7.96	57,260	35	39	1,808	59,855	82,625	2.25	111
3,986	4,673	Y 59	671	789	Y 7	4,347	4,343	Y 64	7,578,009	7,353,707	28,478,678	23,722,600	Y 8.07	1,357,604	870	944	Y 2,012	1,223,614	1,196,443	Y 3.14	Total
IV—WESTERN—Rocky Mountains to Pacific Coast																					
.....	.....	*50	.....	.....	*4	.....	.....	.....	836,066	779,413	14,000,000	14,000,000	1.93	J 1,493,043	152	150	2,850	.....	.....	.....	122
.....	.....	.....	.....	.....	.....	.....	.....	.....	690,448	676,862	2,270,000	2,178,000	4.01	T 101,954	58	59	2,970	.....	.....	.....	123
716	586	59	171	110	7	1,343	1,153	65	1,005,036	783,715	.....	.....	8.93	.....	85	81	1,319	.....	.....	.....	124
160	212	80	40	64	1	258	219	79	577,949	552,078	5,584,089	4,610,616	5.52	62,097	75	87	1,390	.....	.....	.....	125
215	193	.....	39	66	.....	220	185	.....	218,937	221,342	2,885,117	2,663,691	2.83	70,984	30	30	2,578	63,549	103,067	2.16	126
.....	81	.....	.....	.....	.....	.....	223	.....	239,613	260,552	.....	.....	3.40	36,857	50	34	1,408	159,496	21,492	2.67	127
122	116	75	38	42	10	4	8	85	346,627	298,411	3,331,425	2,995,855	5.17	68,492	73	56	921	252,511	71,909	4.69	128
504	557	.....	89	42	.....	163	136	.....	468,525	533,258	2,687,018	2,102,064	8.89	82,126	58	56	918	.....	.....	.....	129
106	72	.....	36	27	.....	112	118	.....	170,739	162,505	.....	.....	7.84	35,000	20	14	1,088	.....	56,033	.....	130
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28,393,781	28,344,979	.....	216,559	220	210	3,220	170,000	547,588	1.04	131
628	587	73	138	136	14	125	98	30	310,963	301,830	2,641,457	2,161,399	6.86	52,268	78	75	581	.....	.....	.....	132
2,451	2,404	Y 67	551	487	Y 7	2,225	2,140	Y 65	4,864,903	4,589,966	61,792,887	59,056,604	Y 5.54	2,219,380	899	852	Y 1,749	645,466	800,089	Y 2.64	Total

N Appliance profit covers expenses. O Includes commercial. P Decrease due to rate reduction. Q Including rural. R Territory beyond company gas mains.
T Major appliances only. Y Straight line average.

Sales Totals, Saturations and Averages

Relating roughly the prevailing cost of using appliances, their present popularity and the scale on which they are being sold.

Ironing Machines Sold per 1,000 Consumers 1939	Vacuum Cleaners Sold per 1,000 Consumers 1939	Average Saturation Refrigerators 1939 %	Average Saturation Ranges 1939 %	Average Saturation Water Heaters 1939 %	Average Saturation Washing Machines 1939 %	Average Saturation Ironing Machines 1939 %	Average Saturation Vacuum Cleaners 1939 %	Total Appliance Sales by Power Cos. (Dollars) 1939	Appliance Sales per Consumer (Dollars) 1939	Total Annual Revenue Increase from Power Co. Sales 1939	Total Sales People on Domestic Load 1939	Consumers per Sales Person 1939	Power Co. Direct Sales Expense 1939	Power Co. Adv. & Promotion Expense 1939	Sales & Adv. Exp. per Consumer	Region
1	6	51	10	3	70	6	69	33,423,830	5.30	2,462,315	4,182	2,478	1,622,839	2,102,028	2.05	Northeast
....	4	58	17	9	41	3	46	8,747,834	5.56	1,095,844	941	2,014	510,347	1,244,791	3.01	Southeast
....	3	54	13	4	59	7	64	7,578,009	8.07	1,357,604	870	2,012	1,223,614	1,196,443	3.14	Central
1	5	49	24	12	67	7	65	4,864,903	5.54	2,219,380	899	1,749	645,466	800,089	2.64	Western
1	4.5	53	16	7	59	6	60	54,614,576	6.12	7,135,143	6,892	2,063	4,002,266	5,343,351	2.71	Nat'l Total or Average


CROSS-SECTION OF RESIDENTIAL LOAD BUILDING FOR 1939
The Customer Bought $38.10 of Lighting and Appliances
$1.00 of E.A.R. Required Mdse. and Ltg. Sales of $11.28 per Cust.
E.A.R. From Sales of $38.10 Amounted to $3.38
To Gain This E.A.R. Utilities Spent $2.12
Customer's Bill Increased 5¢
His Usage Increased 44 Kw-hr.
Logarithmic scale

of E.A.R. for the utility, companies and dealers of group one sold $11.28 of lighting and appliance current-consuming devices, and the dealers of the group two companies sold $14 of lighting and appliance current-consuming devices.

4. To resume, our group one companies spent $2.12 per customer to gain their E.A.R. of $3.38 per customer. This means they got one dollar of E.A.R. for 62.7 cents. Last year the companies reported it cost $1.05 per dollar of E.A.R. when the going was tough (1938).

5. The group two companies spent $1.58 to gain their E.A.R. of $1.96 per customer. This means they got one dollar of E.A.R. for 80.6 cents. Last year the companies reported their cost as $1.10 per dollar of E.A.R. This represents a vast improvement for both groups.

Group One Companies

Cumulative results of these residential load-building efforts, modified by such interim rate reductions as occurred, are taken up later. Therefore at this point we will look over the excellent results hung up, first, by the group one companies, results which are charted and are tabulated in Tables I, II and III.

The year 1939 was marked by a substantial and noteworthy advance in utility and dealer sales of residential electrical appliances and lighting. The group one companies reported sales of $201,622,752, more than $550,000 per day, and, on a comparable basis, 14 per cent above last year.

To gain this reported sales volume these utilities alone spent $36,365,476.45, or $2.71 per residential customer. This is more than $118,000 per business day for residential business only and for 59 per cent of the industry only.

The increase, noted above, of 14 per cent arises from an increase of 4 per cent in direct utility sales and of 16 per cent in sales reported for co-operating dealers. This is the result statistically of the heavy promotional efforts made by the utility, the dealer and the manufacturer and of the common goal of all three to enhance merchandise profits to the dealer.

Utilities at the same time performed as pace-makers and themselves sold directly $6.12 of household lighting and appliances, compared to $5.20 per residential customer a year ago.

Heaviest direct sales by utilities continue in the central region, with high sales of $8.07 per customer in 1939 and high sales of $6.71 the previous year.

Sales Army

An army of 6,892 men and women was employed for residential sales work in 1939 and the western companies increased their employees by 5.5 per cent. There is another point of interest with respect to this sales army, and that is that currently it is increasing faster percentage-wise than the customers. In 1938 there were 2,780 consumers per sales person; this year there were only 2,063. As a result, utility company sales, exclusively, of electric refrigerators increased 13.3 per cent over 1939, sales of ranges increased 0.24 per cent and sales of water heaters 3.72 per cent. These are net sales, omitting conversions and repossessions. It is evident, therefore, that these companies are determined to get more refrigerators added to their lines and are building up the ratio of water heaters to ranges to gain better load factors on distribution secondaries and better net returns from residential major appliance users.

This is not to infer that the sale of ranges has been forgotten, as utilities sold 7½ ranges per 1,000 customers (Table II) and four water heaters per thousand customers, compared to only 6 and 3 respectively a year ago. Based upon saturation, it appears from Table II that the water heater to range ratio will be improved by companies located in the northeastern and in the southeastern zones.

Revenue Building

However, to a utility company, appliance and lighting sales are but a means to an end (albeit the sole practicable means) and so we turn to revenue-building.

A breakdown has been prepared and is presented for the first time of the revenue-building results achieved by those companies which were in a position to co-operate by presenting complete data on their operations (see Table III). Best represented numerically in this study are the cen-

tral and western utilities, as more of the companies in these two groups were able to supply figures on their sales costs, dealer and company sales and E.A.R.

Data in Table III disclose answers to numerous load-building speculations. For example, it will be seen that $133,903,327 of lighting and appliance sales produced $11,824,272 of estimated annual revenue. It took, as stated above, $11.28 of sales to produce $1 of E.A.R.

Next, referring to the first three groups of companies, it will be noted that $11,909,418 of company sales produced $1,703,438 of E.A.R., a ratio of 7. Dealer sales of $85,115,289 produced an E.A.R. of $6,765,730, a ratio of 12.60. Dealers of group two companies operate on a ratio of 14. The dealers obviously are selling appliance volume, but they are not selling E.A.R. Again obviously, dealers are interested in merchandise profits rather than E.A.R. The company that needs more E.A.R. per dollar of sales, therefore, will need more sympathetic dealers or more company sales aimed at producing E.A.R., or both.

Utilities' Responsibility

Here, then, is why a so-called (and mis-called) "monopoly" needs a sales *force*. This is why a sales *direction* is needed. This is why a utility finds itself providing the local sales steam. By attracting dealers into the picture and holding them with a practical and effective working partnership the utility is obliged to provide the guidance.

In brief, it is the utility salespeople who see that E.A.R. develops properly from sales.

The flexibility in calculating E.A.R. is noticeable particularly in dealers' sales columns of Table III. The northeast companies, with an average rate of 4.48 cents, require $1,475 of dealer sales to get $1 of E.A.R. The central zone companies, with a rate of 4.37 cents, require $13.20 of dealer sales per dollar of E.A.R. The southeastern group, with a rate of only 4.09 cents, requires $10 of dealers' sales per dollar of E.A.R. Similar analysis for the western group is impossible because one of the largest companies reported dealer and company E.A.R. in a lump sum.

However, all of these companies and their dealers sold $11.28 of lighting and appliances per customer and gained an E.A.R. of $3.38 per customer during 1939. For it they paid $2.12 per customer (weighted average), or the very low price of 62.8 cents per dollar of E.A.R. Evidently the companies which know their sales costs know how to build residential load economically. For, as shown in Table II, the over-all cost for 1939 was $2.71 per customer.

> ***"The public service business is a service, but it is also a business. If it does not succeed as a business, it does not succeed at all."***
>
> —From address of C. W. Kellogg, President Edison Institute, to General Sales Conference, E.E.I., March 21, 1939.

Increment Data

Turning to new kw.-hrs. for 1939 and bills, it should be remembered that because of rate cuts many average bills dropped despite increases in kw.-hr. sales. One company, in fact, reported a drop of $10.26 in its average residential bill for 1939. However, the companies in Table III derived an increase of 51 cents in the average bill, and for this 51 cents the customer received 44 kw.-hr. Thus he paid 1.16 cents for each added kw.-hr. in 1939. This 1.16 cent figure is a figure that bespeaks the need for selective selling, for revenue building rather than mere appliance sales, the need for more sales to the low-use customer on the high steps of the rate.

Companies included in this analysis are in a better position than the industry as a whole. Part of this is due to their economical load building, part to the treatment they have received at the hands of various regulatory bodies. The industry as a whole added 45 kw.-hr. to the average bill and got 48 cents for them, a price of 1.067 cents per kw.-hr. (see ELECTRICAL WORLD, January 13, 1940, page 85). We've come a long way since 1929, when we got 2.59 cents, or more than twice as much, for each new residential kw.-hr.

Utilities Promoting Sales Through Dealers

The story of six utilities, low on merchandise volume by promotion, low on E.A.R., about average on added kw.-hr., and better than average on average bill increases.

WE NOW TURN our attention to the second group of companies, the companies which not only believe (with most other companies) that it should be the dealer's job to sell appliances, but which go one step further and, confining themselves to promotion, place direct selling in the dealer's lap. Because they are experimenting for the industry, these companies are always of extreme interest.

Table III—Analysis of Estimated Annual Revenue

Group	No. of Customers	Through Company			Through Dealer			Total E.A.R. per Customer	Sales per Dollar of E.A.R.
		Lighting and Appliance Sales	E.A.R. from Sales	E.A.R. per Customer	Lighting and Appliance Sales	E.A.R. from Sales	E.A.R. per Customer		
Northeast	1,175,501	$5,588,238	$705,658	$0.60	$31,106,827	$2,110,411	$1.80	$2.40	$13.00
Southeast	560,047	2,562,622	445,517	0.79	23,629,784	2,359,711	4.21	5.00	9.31
Central	815,496	3,758,558	552,263	0.67	30,378,678	2,295,608	2.82	3.49	12.00
Western	953,407	3,449,514	1,930,964	[1]	33,399,106	1,424,140	[1]	3.52	11.00
Total or Average	3,504,451	$15,358,932	$3,634,402	[Y] $0.69	$118,514,395	$8,189,870	[Y] $2.94	[Z] $3.38	[Z] $11.28

[1] Includes E.A.R. from dealers' sales. [Y] Straight line average. [Z] Weighted average.

Table IV—Load Building Where Utility Sells Through Dealers

Consumption, growth of load, average rates, revenue and number of salespeople and advertising and promotion expense per consumer, together with power company estimates of dealer sales and saturations of the major appliances

Company	Total Residential Consumers		Av. Annual Residential Consumption		Av. Annual Residential Revenue		Av. Price Res. Service — Cents	Refrigerators Units Sold by Dealers	Saturation of Refrigerators	Ranges Sold by Dealers	Saturation of Ranges Per Cent	Water Heaters Sold by Dealers	Saturation Water Heaters Per Cent	Number Power Company Sales Men and Women Building Res. Load		Advertising and Promotion Expense (Dollars)	Adv. and Prom. Exp. per Consumer ($)
	1939	1938	1939	1938	1939	1938	1939	1939	1939	1939	1939	1939	1939	1939	1938	1939	1939
134	198,301	188,441	943	911	36.05	35.19	3.82	14,245	51.2	2,551	6.7	303	0.7	.....	.....	.....	.....
135	H 190,199	186,413	921	879	36.55	36.63	3.97	12,390	55.1	2,161	34.8	978	10.5	.....	.....	.....	.....
136	H 177,340	174,187	764	736	34.15	34.25	4.47	13,054	50.0	1,733	R 30.0	372	R 7.0	75	67	.....	.....
137	169,818	164,383	1,195	1,143	31.40	31.44	2.63	16,874	.....	2,349	.....	403	.....	32	32	.....	.....
138	122,504	118,421	Q 767	739	Q38.28	37.25	Q 4.99	12,373	72.0	100	2.0	24	.....	14	14	80,000	0.65
139	120,332	115,936	1,390	1,317	36.14	35.42	2.64	5,300	51.0	4,602	26.0	1,822	8.0	23	44	109,000	0.88
140	H 86,920	83,924	849	822	30.11	30.51	3.55	7,550	65.0	133	.....	58	.....	2	3	17,500	0.20
141	H 76,618	84,524	986	954	41.07	42.56	4.17	8,797	68.0	1,190	16.0	436	3.0	14	14	.....	.....
142	H 65,353	63,445	981	933	45.35	43.85	4.62	4,497	.....	808	.....	619	.....	21	22	233,825	3.57
143	64,200	62,301	1,300	1,246	43.41	42.47	3.34	4,604	71.0	682	17.7	162	4.1	16	24	158,000	2.46
144	61,353	57,453	845	817	42.48	41.49	5.03	5,406	65.7	329	3.1	18	.....	.....	.....	85,639	1.40
145	40,785	39,562	1,423	1,354	35.43	34.25	2.58	3,615	54.8	1,653	36.7	544	7.4	39	19	.....	.....
146	H 14,116	12,892	932	911	43.07	42.19	4.62	1,200	70.0	150	10.0	50	5.0	2	3	11,306	0.80
147	H 12,289	11,131	1,466	1,440	53.21	52.39	3.64	1,071	67.0	893	53.0	276	18.0	0	2	T 39,461	3.22
Average	1,400,128	1,363,013	Y 1,054	Y 1,014	Y 39.05	Y 38.56	Y 3.87	110,976	Y 61.7	19,334	Y 21.5	6,065	Y 7.1	238	244	734,731	

Y Straight line average. H Company has gas customers. R Territory beyond company gas mains. Q Including rural. T Major appliances only.

The roster this year is distinguished, includes companies highly regarded in the industry. There are combination companies (designated by footnote H) and straight electric companies. Three of last year's members are missing, but newcomers this year give us almost 60 per cent more meters as a starting point. On the other hand, out of 1,400,128 meters listed in Table IV only 547,067, or 39 per cent, reported their costs to build revenue and load. About 400,000 meters (actually 398,794) reported complete data permitting analysis comparable to that followed for companies represented in the foregoing section of this survey.

Regrettable as it is for the utility industry to lose this once-a-year opportunity to profit from the experiences of all fourteen of these companies, we can proceed to analyze 1939 operations for companies 138, 139, 142, 143, 146 and 147.

This is not an analysis of the so-called "non-merchandising" companies. It is an analysis of 398,794 meters, or 28.5 per cent of the meters represented in Table IV.

Appliance Sales

Dealers' sales reported by these companies for 1939 amounted to $10,986,000, about $27.53 per residential customer. The E.A.R. resulting from these sales was $784,179, so that it took $14 of dealers' sales (as these companies do not sell directly) to gain $1 of E.A.R. for the company.

Expressed another way, the sales by dealers were 27–28 per cent short of combined dealer-and-utility sales (see Table I) on a per-customer basis, and the dealer volume had to be 24 per cent greater to produce $1 of E.A.R. for the utility.

This is one statistical measure of the extra motion involved when a utility, often for very good reasons of a local nature, routes all sales in the territory through dealer channels.

These dealer sales of $27.53 per customer resulted in an E.A.R. of $784,179, or $1.96 per customer.

To gain this E.A.R. these utilities spent $631,592 on residential sales promotion, or $1.58 per customer. Therefore they gained $1 of E.A.R. for only 80.6 cents. As in the case of the majority of the companies in the industry, as shown in Table II, this was very economical load building compared to costs reported in 1938.

Next, how did these companies make out with load building? The average consumption in each of these companies increased in 1939, as did the average bill. No rate reductions were reported. In the case of the average bill, the increase was 41 kw.-hr., and for these added kilowatt-hours the customers paid 98 cents. Thus the new kilowatt-hours added in 1939 by these companies brought 2.34 cents per kw-hr. into the cash registers of these companies.

In brief, these six companies which promote sales through dealers (one of them reported that actually it made 10 per cent of the sales) did not get appliance sales volume from their dealers, and it took larger sales to produce a dollar of E.A.R. Yet they paid only 80.6 cents for a dollar of E.A.R., compared to $1.10 a year ago.

On the other hand, from the standpoint of revenue building and load building they fared exceedingly well. They gained about the industry average in new killowatt-hours, but the bill went up twice as much as the industry average. They earned 98 cents more, the industry only 45 cents more. They earned 2.39 cents per new killowatt-hour, the industry only 1.07 cents (see ELECTRICAL WORLD, January 13, 1940, page 85).

The End Result

These companies have an average rate of only 3.98 cents, 0.7 mill below the industry average. But judging from the facts here presented, they seem to have their eyes fastened upon revenue building as well as upon merchandise sales.

This apparent inconsistency may be due to the fact that those companies reported no rate reductions.

In short, what the companies taken all together prove for themselves here is that the utility problem of load and revenue building is only approached through, and not solved by, merchandise and lighting sales. Briefly, these sales are but a means to an end, that end being to build revenue.

Lower Cost Electric Cookery

Central Hudson develops new equipment specifically for low-income customers — Displaces competitive fuels and develops added usage of 64 to 75 kw.-hr. per month

H. E. DEXTER, Vice-President Central Hudson Gas & Electric Corporation, Poughkeepsie, N. Y. and Chairman General Sales Committee Edison Electric Institute

EVER SINCE 1930, which is a period of nearly ten years' duration, sales departments of public utility companies have been charged with the responsibility of providing the gross and net incomes which would keep these companies in solvent existence.

Prior to 1930, and looking at the industry as a whole, we all recall the pleasing scene created by the constantly improving gross revenue picture. Revenues from industrial business, from commercial business and from residential and farm business went to new high levels with each passing year.

My point in reviewing these familiar memories is to emphasize the changes in our jobs which have taken place since the good old days of ten years ago. For in 1930, almost overnight it seems, our industrial revenue started to plunge downward, a year later commercial revenues began their four-year decline, but our residential revenues, on the other hand, were held within 4.6 per cent of their 1931 high of $653,282,000. (See ELECTRICAL WORLD, January 15, 1939). All through the depression, as well as through the subsequent "recession," our residential business has brought more revenue into our cash registers than any other classification of the business.

Residential Vital

It is apparent, therefore, that this residential business is of immense importance to us. It has climbed—on an ascending scale—since 1933, so that the *increase* alone in farm and residential was over $185,000,000, or more than 27 per cent.

Unfortunately, perhaps, we now average only 4.2 cents per kilowatt-hour from residential service, whereas in 1930 we averaged 6 cents. So to overcome this great drop in the price of our product we have had to sell more units. This the industry has done with great success through the sale of lighting and major appliances in the farm and home.

However, the job is far from completed. Even today 50 to 60 per cent of the nation's residential electric users are doing without conveniences they should have simply because they contend that they have not been able to afford the standard electric appliances. Making little use of electric service, they are non-profitable customers to the utility. They need and want modern conveniences just as much as families with more money to spend, while the electric companies need the killowatt-hours that could turn these non-profitable customers into sound, increased business.

This 50 to 60 per cent of our residential customers, numbered in the millions, are of extreme importance to us. They represent a tremendous market for sales if only we are foresighted enough to recognize their needs and practical enough to supply these needs at a price which they feel is within their limited purchasing power.

Other American businesses have seen this situation and by supplying the needs of American families have been rewarded with great success. Why do you suppose there are more Fords, Chevrolets and Plymouths traveling the highways than Packards, Buicks and Cadillacs? A visit to any of Henry Ford's plants indicates what meeting the challenge of the slim pocketbook means to him in produc-

[*Continued on page 151*]

THIS NEW DEVICE uses 64 to 75 kw.-hr. per month, doing the cooking for families of five on lines of Central Hudson Gas & Electric Corporation

Editorials

S. B. WILLIAMS, *Editor*

SEC Moves on Integration

TIME has run its course. The Securities and Exchange Commission has moved to enforce the integration provisions of the Holding Company Act. Show cause orders have been issued against Electric Bond & Share and against Engineers Public Service, returnable April 6, with hearings to start three weeks later. At the same time SEC stated that similar orders will be issued against seven other large holding companies. (All are expected to be issued by the time this comes off the press.)

This is one of the most difficult pieces of legislation that any government agency has had to administer. The provisions of the act, so long as they are on the books, must be carried out, yet public policy demands that this be done in such a way as not to destroy existing values.

The act has been on the books for nearly five years. Two years ago the Supreme Court declared the registration provisions constitutional. Then the utilities were given until December of that year to file tentative integration plans. Now, more than a year later, come these orders.

Thus SEC has put itself in the position where public opinion will be that the commission has not acted hastily, while the holding companies have had ample time in which to prepare plans. In some cases plans might have been prepared, but in the others it is doubtful if any acceptable plans could have been drawn up by holding companies collaborating.

The sentiment has often been expressed that something might happen to soften the effects of Section 11 of the law—sometimes called the death sentence. The Supreme Court can do the trick, but is it conceivable, with its present make-up? A different Congress might modify these provisions, but could it get around to it before the Supreme Court had had an opportunity to review a test case?

Of course, any final orders of SEC will find their way to the Supreme Court, but the more the holding companies help the commission to arrive at workable plans the easier they will be to live under if the court does find Section 11 constitutional.

Five years is a long time for fear and indecision to hold an industry back. Nor is the waiting time over, for there is still the time for hearings, formulation of plans and court review. If, as has been said so often, expansion and equity financing go hand in hand, the sooner we remove the fear and doubt from the minds of would-be stockholders the sooner expansion can proceed. There is not the slightest question but what the absence of equity financing during the past five years has to a great degree been the result of lack of confidence engendered by the uncertainty of the application of Section 11 of the Holding Company Act.

Load Building and Employment Building

IF EVERYBODY is right that the future of our national economy depends on the measures taken to reduce unemployment, then a study of the Appliance Sales Survey presented in this issue will be very illuminating.

Most consumer sales are dependent upon retailer efforts, and as a result such sales are in proportion to the average consumer purchasing power. For that reason sales are well below the 1929 level. The result is decreased employment in sales and production forces.

Electric appliance sales, on the other hand, are above those for 1929. Why? Because there is another element in the transaction that is not satisfied to float with the tide of business—the utility. It is true that the larger part of the sales are through the dealer, but that is not the whole story. At least a quarter of the dealers' cash register totals represent sales made by the utility and turned over to the dealer to fill. By far the largest part of local promotion is done by the utility, and besides the utility has an army of outside salespeople drumming up trade.

The utilities have deliberately encouraged the dealers, for their sales help build up the kilowatt-hour consumption. Nevertheless, by so doing the employment of dealer salespeople has increased. Also, by increasing sales the employment in manufacturing shops increased and the effect was felt way down to the mines.

In other industries promotion falls off when times get bad, but just the reverse is true with utilities. If the utility promotion were to stop for a year dealer sales would dwindle and unemployment would increase.

In 1938, for instance, the only thing that prevented dealers from dying by the scores was the assistance given by utilities in greater promotion and in actual sales turned over to dealers.

We sometimes wonder if appliance manufacturers, when they condemn utilities for wanting this or that, are fully cognizant of where they would be without utility local promotion. Where manufacturers ignore the utility and confidently believe they can get all they want through the dealer, we feel they are ignoring facts.

Likewise the government. The utility is one of the few constructive elements of American industry that is not willing to sit back and wait for conditions to improve. It not only builds employment through appliance sales but, in turn, finds it necessary to spend annually hundreds

of millions of dollars to provide for additional plant to take care of the resulting increased load.

Thus the utility load-building efforts are a double-barreled means for putting more men back to work. We should be careful not to harm the goose that lays such golden eggs.

More Instrumentation Would Give More Facts

DESPITE the relatively small cost of electrical energy per unit of manufactured product in most modern industries, far too many processes are carried on in a kind of No Man's Land when it comes to accurate data on the kilowatt-hours required for particular duty cycles. Motor requirements are better understood today than of old; remarkable progress has been made in the design of control equipment and systems, and electrical efficiencies are often the envy of our mechanical brethren. But even now, with all the resources of instrumentation available to the art, rough estimates of energy consumption and very approximate ideas of the relation of power demands at various stages of the production chain prevail in countless cases.

Here would seem to be a real opportunity for the power sales engineer to serve his customer and his own company, given a liberal outlook on testing and instrumental applications for at least temporary purposes on the part of executives. It may be too much to expect the average manufacturer to make a fine study of these electrical conditions once his equipment is functioning successfully, but in many cases it would be a paying investment to allocate much more money to instrumentation.

As a specialist in the detailed and economic application of electricity to all sorts of processes, the power sales engineer is certainly in a position to advocate and carry out more work of this kind, provided the management of his company is possessed of constructive imagination.

Credit to the Originator

HARDLY any manufacturer would insist that his own staff of engineers creates all the devices which he offers to the industry. It is too well known that new items of line hardware, tools, relays, air switches, etc., often develop from ideas submitted by ingenious utility engineers who originate something new, something cheaper, something simpler. After a few special orders, these inventions appear in the catalogue and then others adopt them, and they ultimately become established products. Some, of course, fall by the wayside. The great majority of the devices merely get dignified by a new catalogue number and the human identities soon vanish.

One utility engineer recently showed an editor, partly with pride and yet somewhat wistfully, several recent clippings from ELECTRICAL WORLD'S new equipment columns. Several different manufacturers had adopted his various suggestions, but nowhere was there any clue in the announcement or the manufacturer's subsequent literature that the idea came from this practical operating engineer.

It might be good business for more manufacturers to give recognition to the source of many of their adoptions, possibly by coupling the name of the utility engineer with the product. In most cases that would mean more to him than whatever compensation or royalty he might receive. Fortunately utility managements are tolerant toward arrangements of this kind, merely expecting the privilege of deriving for their own property the benefits of use of ideas often originated and perfected on company time. Give the device a catalogue number if it must have one, but by coupling with it a name two parties then have the opportunity to point with pride.

The Diesel Revolution Gets a Convert

PRETTY SOON all the big generating stations will be shut down, the government-financed hydro-electric projects will have to assign all their costs to navigation, flood control and irrigation, poles and towers carrying distribution and transmission lines will be jerked out by the roots and each home, store, factory and public building will have its own individual power plant all to itself. This is not a new idea. Every once in a while some one proclaims it to the world.

Hugh S. Johnson saw a Diesel a short time ago and immediately his syndicated newspaper column burst forth with the old familiar phrases. We have a considerable affection for "Old Iron Pants" because he usually thinks our way. As, for instance, in the same essay in which he extols the Diesel, he also speaks of the "dizzy, if not fraudulent, figures of cost of government-produced hydro-electric power." But when he offers to bet that the Diesel engine "will go far to revolutionize the electric power industry" we rather deplore the enthusiasm of his language.

"Revolutionize" is a pretty strong word. Too strong, in fact, to apply offhand to any technical development. In industry new things have to prove themselves in use and experience before they displace the old in very large measure. And then displacement is gradual, too slow to be termed revolutionary. But the average person does not know, or does not think, of this when he reads the words of a columnist prophesying a technical revolution. He gets the impression from the General's statement that the present manner and method of electricity supply is going to change overnight. Not only is that not the picture, but there is nothing to indicate a growth in Diesel stationary power compared to expansion in utility service.

Consider Your Congressman

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

HOW does *your* congressman stand on public ownership?

More important—does he believe in federal subsidies for locally owned electric systems?

This is nothing like so interesting, of course, as who is going to be President. It is not as spectacular as the third term, or the race between Dewey, Taft, Vandenberg and Bricker for the Republican nomination.

But actually, if you happen to be a security holder in an electric company, or if you are a taxpayer, even to the extent of buying cigarettes, the prospect of accomplishing something is a hundred to one better if you play a part in influencing your local congressman than if you concentrate on the presidency.

When it comes right down to cases, you are a small minnow in a pretty big pond when it comes to the presidency. This year more than normally. But you can easily become a real influence on the nomination and election of your congressman.

Consensus of Washington experts, totally uninfluenced by what they *want*, is that if Franklin D. Roosevelt is renominated he will be reelected. And most of them think he will be renominated.

They may be wrong. But it's the best expert opinion we have. While you may not be willing to accept it, it would not be prudent to ignore it utterly.

New Dealers Want It

Now we *know* where Roosevelt stands on the public power question. We know where his lieutenants stand, particularly Harold Ickes, who has been dishing out the loans and grants, and John D. Carmody.

But do we know precisely where any of his possible opponents stand on this question? Even if we did have the exact knowledge required, what could be done about it? Certainly nothing in the primaries. There is only one real primary battle in the Republican race, and unless you live in Wisconsin you are barred from that. Moreover, only Dewey and Vandenberg are contesting even in that. Taft and Bricker, very real possibilities, did not enter. Of course you may be potent enough in your community to influence a few delegates, perhaps even one of those museum pieces, a state boss. If you are as big as that, and working at it, just make sure you aren't double crossed!

But when it comes down to your congressman, no matter how unimportant you may think yourself, there *is* something you can do. Providing of course, that your congressman is not 100 per cent with you already, and sure of both renomination and reelection.

The importance of this Congress business is very clear, but not generally recognized by the very type of people who ought to be most interested—those who believe that the American profit system has proved the best economic system in the world's history for every man, woman and child in the country, so far as opportunities and standard of living for the bottom strata are concerned. It is realized very vividly, unfortunately, by those who want to change our economic system into something that has been tried and tried again, but has never succeeded.

The point is best illustrated when it is realized that the margin between the economic groups—as distinguished from the political party label groups—is very close in the House at this moment. For example, one of the votes by which TVA escaped partial emasculation in the House this session was decided by a majority of three! A change of the votes of *just two* congressmen would have thrown the TVA for a loss.

On top of this a careful calculation shows that a Republican swing, as applied to the election of members of the House this fall, need only be in the ratio of the recent Ohio special congressional elections to insure Republican control of the House. This would mean a Republican Speaker and Republican control of the various House committees. It might be a great deal better, on this simple question of government competition with private business, to have more Democrats such as A. J. May of Kentucky, Eugene Cox of Georgia and Howard Smith of Virginia than a lot of new Republicans. But fortunately most of the Democratic members who have been voting for economy and against subsidizing public ownership are not in danger. The New Deal did its utmost against them in 1938, and failed except in one case.

How Did He Vote

The important thing is to make sure where *your* congressman stands. How did *he* vote on these close tests? There were plenty of Democrats voting with G.O.P. Leader Martin on the economy side. There were a few Republicans voting with the spenders. A man has to "rise above principle," as Senator Ashurst says, when there is a big public ownership payroll being spent in his district.

Now it is little short of amazing how easily a congressman can be influenced; that is, how a few voters in his district can frighten the life out of him. But generally it's the nuts and the radicals who write him letters, or pay him visits. The nuts do it because they are nuts. The radicals, on the other hand, are closely organized, and shrewdly directed.

But the people with the biggest stake tend to their own knitting, and let politics alone. Not a single constituent wrote to his congressman from the old 17th New York district when the Esch-Cummins law was being considered. Yet in that district more railroad securities were owned than in any other in the country! Then up came a little bill affecting florists and the congressman was deluged!

NEWS OF THE WEEK

Ice Storm Causes Severe Damage to Utility Lines

Black-outs common in communities hard hit by worst storm in twenty-five years — Power companies rush extra crews to affected areas to restore service — Damage estimated in millions of dollars

The worst ice storm in a quarter of a century struck parts of New York, New Jersey, Connecticut and other New England areas Sunday and Monday this week, causing millions of dollars' damage to power and communication lines and to property. Homes and factories were without light and heat and telephone as service was disrupted due to breaking of lines by the heavy coating of ice and falling trees.

Many of the communities in the affected areas were isolated and black-outs were numerous during the early part of the storm. New breaks in electric and telephone lines added to the damage and disruption of service. However, utilities brought in extra crews from other areas to repair lines and restore service. At the week-end most of the utilities reported repairs had been completed and service normal.

Extra Crews Help

C. L. Campbell, president of Connecticut Light & Power, reported that the storm was the worst in the history of his company. Ice-laden wires were snapped by falling tree branches, disrupting the state-wide transmission system. Temporary shutdown of industrial plants was necessary in order to shift power to domestic and other urgent customers. The company had 28 line gangs in Norwalk, including fourteen from outside—four from Pennsylvania, two from Boston, two from western Massachusetts, two from Hartford Electric Light Co., one from Connecticut Power Co. and three from a contractor.

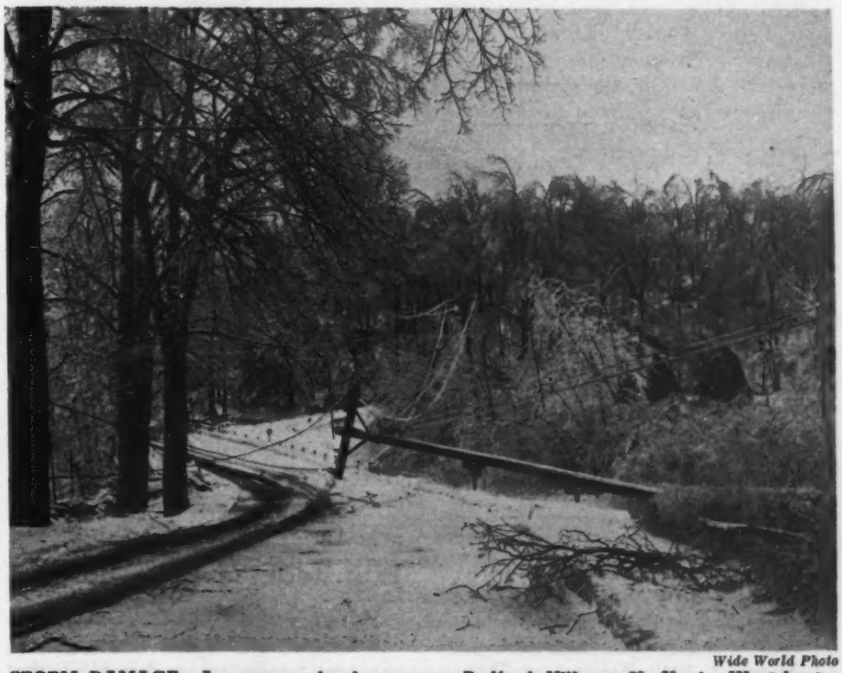
Mr. Campbell said that all of the distribution system in the southern division was out at one time. Service was being quickly restored throughout the company territory.

Niagara Hudson Power reported that there were no emergencies in its territory. There was some snow.

Consolidated Edison of New York reported that there was small damage in Brooklyn and Queens, but that the Bronx was hard hit. There were 23,000 customer interruptions in the Bronx, about 4 per cent of all customers, due to trip-out of nineteen overhead feeders and sleet-covered wires. There were 325 service cables down, more than 100 poles affected and 500 sections of overhead wire down. By early Tuesday morning 80 per cent of the service was restored and full service by night. The company had 800 working to restore service in the areas.

Westchester County, served by Westchester Lighting Co., was hard hit by the storm, with service in many of the communities out for two to three days until line breaks could be repaired. Extra line crews were rushed into the affected areas to repair transmission and distribution lines. Falling trees tore down lines and made repairs difficult.

Long Island Lighting Co. reported many lateral lines in wooded areas seriously affected. There was serious damage to distribution systems along the



Wide World Photo

STORM DAMAGE—A power pole down near Bedford Village, N. Y., in Westchester County, typical of scenes in New York, New Jersey and part of New England, where the worst ice storm in a quarter of a century struck this week, causing severe damage

Wide World Photo

UTILITY TRUSTEES—Dr. Willard L. Thorp, Dennis J. Driscoll and Walter H. Pollak (left to right), who were appointed last week by Federal Judge Vincent L. Leibell as trustees for the two top companies in the $1,000,000,000 Associated Gas System

North Shore communities. Extra crews were dispatched from the South Shore and Queensboro Gas & Electric Co. to repair damage. Many of the main feeders were back in service by Monday afternoon. New breaks on lines repaired kept crews busy. Rain hampered repair work. The company said that the problems resulting from the storm were the worst since the September, 1938, hurricane.

New Jersey Power & Light reported that all five of its 110,000-volt high-tension lines had been damaged.

Public Service Corp. of New Jersey reported disruption of house and street lighting circuits. The storm centered in Bergen, Essex and Hudson counties, and Perth Amboy, Elizabeth, New Brunswick, Trenton and Burlington were hit. Montclair, the Caldwells and the Oranges also suffered disruption of service.

Utility executives declared that the extent of the damage will not be fully known until all repairs have been made.

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Freezing Fog Snaps Oregon Power Lines

Freezing fog, so thick that a flashlight could not be seen from the top of a pole, laid an estimated 40-ton ice burden on seven spans of 66-kv. line in Oregon last month, snapped the line twice and gave emergency crews a 19-hour battle. But at Hood River, almost within sight of the break, only a flicker in consumers' lights recorded the havoc on nearby Indian Mountain (see page 13, March 2, 1940, ELECTRICAL WORLD for picture).

At the height of the storm ice-sheathed lines measured 21 inches in circumference. To reach the first break line crews had to cut steps in the ice up a steep three-quarter-mile slope. Hardly was the first break repaired when another section snapped. One pole broke in three parts and another was torn bodily from the ground.

All available man-power was put on the job. Charles Kruse, line superintendent at Hood River, and his crew of 24 men restored service.

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Plead Guilty to Sabotage Charges in Indiana Case

Two men pleaded guilty to state and federal charges growing out of sabotage of property of the Indiana and Michigan Electric Co. It was charged that the campaign of destruction was undertaken to force the company to withdraw from a National Labor Relations Board case and to make its employees change unions.

The men who pleaded guilty are Parrish E. Freemen of Joliet, Ill., a former convict, and Frank S. Lung of South Bend. A plea of not guilty was entered by a third man, John A. Marks of Michigan City, business agent of a local union of the International Brotherhood of Electrical Workers. He was held on bonds totaling $205,000.

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Will Redeem 4½% Bonds

Marion-Reserve Power Co. has notified holders of its first mortgage 4½ per cent bonds, series due 1952, that the entire issue has been called for redemption on April 20, 1940.

Trustees Appointed for Associated Gas

Unscrambling of the intricate corporate structure of the Associated Gas & Electric system and its reorganization to meet the requirements of the utility holding company act now rests with the three trustees appointed late last week by Federal Judge Vincent L. Leibell. The trustees are considering having their offices at 61 Broadway, present New York offices of the company.

Walter H. Pollak, a New York attorney, was appointed sole trustee of Associated Gas & Electric Co., while Dr. Willard L. Thorp, economist, and Dennis J. Driscoll, chairman of the Pennsylvania Public Service Commission, were chosen trustees for Associated Gas & Electric Corp.

Judge Leibell stated that he had informed the SEC of the appointments and that "the commission, after due deliberation, raised no objection."

After discussions of the problem confronting the three trustees, Dr. Thorp said he believed the trustees' first objective would be to determine the causes which brought on the bankruptcy of the two companies.

Judge Leibell emphasized the fact that the trustees will be independent of any governmental agency and responsible only to the court. He said that the trustees would cooperate with the SEC in examining Associated's affairs, and that the preliminary hearings in drawing up a plan for integration and corporate simplification for the system would be initiated by the commission.

The appointment of the three trustees came as a surprise for a number of others had been mentioned. Mr. Driscoll tentatively accepted the appointment this week. He had unofficial word that the trusteeship would pay more than double his present $10,500 a year salary as PUC chairman.

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Raver Indorses Proposal to Acquire Power System

Proposal of the public utility districts' negotiating committee to acquire the entire system of the Puget Sound Power & Light Co. has been indorsed by Paul J. Raver, Bonneville administrator.

Mr. Raver wired A. G. Ziebell, chairman of the PUD committee, that he was "in thorough sympathy with the announced objective. The commissioners are acting in good faith, within their legal powers, and according to the mandate of the people of their respective counties in this program," he said.

More Utilities Notified to Begin Integration

SEC sets dates for public hearings on plans to be presented by Middle West, United Gas Improvement and Cities Service Power & Light — Companies will co-operate to effect plans

Proceeding with its announced intentions of citing the major utility systems to begin active integration of their operating properties as set forth in the utility holding company act, the Securities and Exchange Commission has sent notices to Middle West Corp., United Gas Improvement Co. and Cities Service Power & Light Co. and will follow these with ones to the other companies in the near future.

Last week Electric Bond & Share and Engineers Public Service were the first two utilities to receive notices to actively begin integration plans and to prepare for public hearings on their proposed programs. The SEC said that Electric Bond & Share and Engineers Public Service were the first two called because they represented the "largest" and "smallest" systems.

Hearing Dates Set

The SEC set April 12 as the date on which United Gas and Cities Service must file answers to the show cause orders and set May 2 as date for public hearings. Middle West has until April 9 to answer and public hearing will start April 29.

P. L. Smith, chairman of Middle West, said that the company "will make an orderly and extended presentation of all the facts and factors which in our opinion are relevant and pertinent in the matter." He said that the hearings after initiated will take a considerable period of time inasmuch as voluminous data must be prepared and presented and lengthy testimony will be given.

C. E. Groesbeck, chairman, and S. R. Inch, president, of Electric Bond & Share, last week sent a letter to stockholders, along with the annual report, outlining the position the company took in regards to integration and outlined the plan of integration filed with the SEC in November, 1939.

It was stated that the company is pledged to a policy of co-operation in any plan which can be worked out between the SEC and itself whereby the interests of the consumers served by the system and the investors who have provided the capital to make that service possible will be protected.

"It was with this idea in view," the company stated, "that the integration plan previously filed with the commission was prepared and submitted. This also is the motivating idea back of the efforts of the company to co-ordinate the facilities of its operating subsidiaries with those of the federally financed projects in their territory with the very encouraging results which have been reported to stockholders from time to time."

It was stated in the letter that the annual report had been prepared for some time and "it is only a coincidence that its release occurs at the same time as the statement of the SEC regarding the action by it as to the Electric Bond & Share Co."

Donald C. Barnes, president of Engineers Public Service, stated that his company would continue to cooperate with the SEC in working out integration plans. The company hopes to present to the commission facts which will justify an order approving the retention by the company of at least a substantial part of its present system, he said.

As the week opened, American Gas & Electric resumed its testimony before SEC on its plan of integration. Philip Sporn, vice-president and chief engineer, continued his presentation of operations of the central system.

Public reaction to the show cause orders of the SEC was a selling of utility securities and a gradual decline in prices.

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Turbine Blade Tests Made in Experiment

What goes on in a high-pressure steam turbine was viewed for the first time last week as members of the Philadelphia section of the American Society of Mechanical Engineers saw how steam under terrific heat and pressure is harnessed to furnish power for industry.

Philadelphia Electric Co. and Westinghouse Electric & Manufacturing Co. are jointly carrying on experiments at the Schuylkill generating station to determine the little-known properties and behaviors of metals when subjected to high pressures and temperatures. A specially constructed high-speed steam turbine, embodying advanced features of construction, is being used. An ingenious optical system has been devised whereby a beam of light is carried through the shaft of the turbine and up into the blade itself, where mirrors reflect it out again, and an automatic camera takes pictures through a tiny

TURBINE BLADE PERFORMANCE—Vice-President N. E. Funk (center) of Philadelphia Electric and F. T. Hague (left), Westinghouse engineering manager, and R. P. Kroon, in charge of Westinghouse experimental division, make final inspection before putting into operation a specially built turbine which will be the instrument of a joint research on turbine blading at high pressure by the two companies conducted at the Schuylkill generating station of the utility

quartz peep-hole in the shaft at the rate of two per second. These pictures show blade action.

The turbine blades were subjected to a steam pressure of 1,250 pounds and temperature of 900 deg. It was found that the blades react much as a tuning fork.

Story of the experiment will be found on page 60 of this issue.

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Reed Defends System of Free Enterprise

The trend of national feeling is away from "the something for nothing school of thought," away from past willingness to experiment "here, there and everywhere," Philip D. Reed, chairman of General Electric Co., told "old friends and fellow alumni" of the University of Wisconsin last week.

"Unless business deterrents are removed and the American people turn confidently and eagerly to the task of making ever better, ever cheaper goods for more people to buy, there can be no permanent answer to unemployment," Mr. Reed declared.

It was pointed out by Mr. Reed that the ignorance of what private business is and how it functions was "the greatest single threat to national progress." For a people to permit its government not merely to regulate but to control and compete with its private business enterprises is evidence of "a tired and misguided democracy" headed for dictatorism, he asserted. If a job can be done with private capital under the profit motive system, every American should insist, Mr. Reed said, on it being done that way because "it surely will be done better and at less expense."

Mr. Reed suggested that the best preparation for the part business is to play "in the economic rough and tumble that may lie ahead" is "a good look at itself in the mirror and a course of diet and training to remove anything not functionally essential."

He also urged business to "restore its corporate figure," put "tone and vitality into every part," oppose every program that will weaken free enterprise and face the future with "confidence and high courage."

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Breaks Up Company Union

National Labor Relations Board has announced a decision requiring Virginia Electric & Power Co. to disestablish the Independent Organization of Employees of Virginia Electric & Power Co. as a collective bargaining representative for any of its employees.

State Industries Oppose St. Lawrence Proposals

Ratification of treaty with Canada meets with strong protests — Albany meeting voices objections to waterways and power project as affecting business — Sees ample supply in Canada

Protests against ratification of the proposed new treaty with Canada for the construction of the St. Lawrence waterway and power project was voiced last week in Albany, N. Y., by industries of New York State. Joining the opposition were members of Congress and the state Legislature, representatives of organized labor and of commercial and civic organizations.

The delegates to a meeting, held under the auspices of the New York State Waterways Association, attacked the waterway plan from both economic and patriotic angles. Domestic coal, steamship lines, railroads and other businesses would be seriously affected, it was charged.

Attacks Subsidy

Chauncey J. Hamlin, chairman of the Niagara Frontier Planning Board, criticised the New York State Power Authority for advocating granting a subsidy of $40,000,000 to the Ontario Hydro-Electric Commission to be paid by the United States.

"In granting this subsidy," he said, "the Power Authority sets up on the Canadian side of the river a competing enterprise with a much lower investment than the enterprise on this side. At the same time, the Power Authority would foist upon our whole country and also upon Canada a seaway which will strike a death blow to the railroads of both countries and create a serious menace to the security of Canadian and American labor, transportation and industry."

John C. Watson, representing the Albany Port Authority, scored "the attempt being made" to control the power resources of the country.

"Once the bureaucrats at Washington get their hands on the nation's power plant, then would the dream of dictatorship come true," he declared.

Opposition to the project was voiced in other quarters. James Wilson, president of Shawinigan Water & Power Co., Montreal, told stockholders at their annual meeting that the project cannot be justified on the grounds of power needs in Central Canada.

"It is my considered opinion," he said, "that so far as power for either wartime or the immediate post-war needs of Central Canada is concerned, ample supplies of power can be made available from wholly Canadian resources without resorting to vast capital expenditures in connection with a project the value of which is a matter for serious differences of opinion."

Congress May Delay Action

In Washington opinion was expressed that the tremendous amount of opposition to the project and the difficulty in reaching agreement between the two countries make it unlikely that Congress will consider the treaty at this session. Another factor which is likely to delay consideration is the desire of Congress to "go home" to prepare for the November election. Some progress has been made on the St. Lawrence treaty, it is said, but many things are yet to be considered before it will be in shape for Congress to voice opinion.

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Refuses to Review Duke Power-PWA Case

The U. S. Supreme Court has denied review of a suit against the Duke Power Co. and Southern Public Utilities Co. for alleged damages to a PWA-constructed electric power plant in Greenwood County, South Carolina. The county was seeking to collect damages from the Duke company for loss of business supposedly suffered by its plant because of injunctions against its operation obtained by the utilities.

By refusing to review the county's suit the high court in effect affirmed the lower court ruling that the county is not entitled to recover from the company.

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Bangs Goes to Jail Again

Clare W. H. Bangs, who spent four turbulent years as Mayor of Huntington, Ind., is back in jail again as an indirect result of his long fight with privately owned utilities. He is charged with contempt of court because of his failure to post an appeal bond or account for $4,300 alleged to be missing from the funds of the municipal electric plant which Mr. Bangs established.

Robertson Sees Drop in Business at End

Believes healthy growth in store for industry — Points to sales increases

Continued healthy growth of business during 1940 is anticipated by Andrew W. Robertson, chairman of the board, Westinghouse Electric & Manufacturing Co., who stated in an interview at Boston this week that he did not believe the fact that this is a presidential election year would prove a deterrent to industry and trade. Mr. Robertson said that the company's New England sales ran 70 per cent ahead of a year ago during January and February, and while he hardly expected this rate of gain would be maintained in the coming months, the management of the Westinghouse company is of the opinion that the current recession in the country is pretty nearly over. A factor in the New England increase has been the expansion of production in her shipyards.

"We now have a backlog of orders aggregating about $80,000,000," said Mr. Robertson. "The demand for household appliances is vigorous and the market for electric refrigerators, many units of which are made at the East Springfield works, is hardly less than tremendous." Mr. Robertson said that about 25 per cent of the company's output is in consumers' goods.

Utility Outlook Good

To a representative of ELECTRICAL WORLD Mr. Robertson said that the outlook for public utility development was apparently good, with the possible exception of the adverse effect in some cases of governmental investigations. An encouraging item is noted in a recent finding of the New York commission permitting an upward rate adjustment to offset increases in taxes.

Turning to New England conditions again, the Westinghouse chairman said that the company now has over 4,400 employees in these six states and a New England payroll of over $650,000 per month. "A few years ago," he said, "we heard a good deal in other parts of the country about New England's industrial slippage, but the influx of new industries into the northeast to take the place of those which have gone elsewhere or otherwise reduced in importance locally has made such headway that we are glad to have our expanding plants in a region of such enterprise. The company as a whole now has over 50,000 employees, a gain of over 10,000 over 1938. The 1939 payroll exceeded $80,000,000 for Westinghouse personnel everywhere." Last year, he stated, Westinghouse taxes totaled $3.85 per share, a little more than was paid to the stockholders. Thus far the war in Europe has had a relatively small effect on American business with the exception of airplane plants.

OPTIMISTIC OUTLOOK—Westinghouse Electric & Manufacturing Co. executives expressed views of optimism on business prospects this week in Boston. Standing (l. or r.) Frank L. Nason, New England manager; Andrew W. Robertson, chairman, and Ralph Kelly, vice-president in charge of sales. Seated is John L. Hall, director, Boston

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Utility Starts Change Over

The first step in changing over all electric customers in the Ontario district of the Niagara, Lockport & Ontario Power Co. from 25 cycles to 60 cycles was taken recently when inventory of customers' appliances and equipment was started at Sanborn, N. Y. Charles W. Boyce, Ontario district manager, estimates the district changes will require two years to complete.

Healy Out as Sponsor of SEC Utility Section

Commissioner Robert E. Healy of the SEC has relinqu'shed his position as sponsor of the utility division, because of differences over personnel with Joseph L. Weiner, director of the utility division.

Judge Healy, an outstanding authority on utilities, will probably devote a large part of his time to the investment trust section, which is to be set up by the SEC. His resignation comes at a time when the SEC is entering upon the important task of utility integration.

California Utilities Not Hurt by Flood

Record rainfall, falling almost continuously between February 24 and 28, which brought rivers in northern and central California to flood crests—in some instances higher than those of 1937, when serious damage was done to power houses and lines—failed to interfere materially with electric service. There were only isolated instances of interruptions and most of those were in areas inundated by floods from the Sacramento River.

Some hydro-electric plants were shut down due to high water, but precautionary measures kept water from power house interiors. In 1937 several plants were flooded and seriously damaged.

Many cases of heroic action on the part of employees of the Pacific Gas & Electric Co. were reported from the flooded areas. These involved the rescue of families marooned in flooded towns and on farms.

A few minor distribution lines were reported down, but these were in sections where high water forced abandonment of homes or of reclamation pumping plants.

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Jackson Drops Surcharge

Announcement has been made that Jackson, Tenn., has eliminated the 10 per cent surcharge from the electric bills of residential customers.

Niagara Falls Power Water Use Attacked

Demands were made this week for the cancellation of the license of Niagara Falls Power Co. to use water from the Niagara River for power generation and the sale of the utility's properties in western New York to private bidders or taken over as a public project.

In proceedings before the Federal Power Commission, attorneys for the commission and the Power Authority of the State of New York recommended rejection of the application of the utility to divert an additional 275 cubic feet per second of water from Niagara River. It was charged in briefs filed that the utility now "is inefficiently utilizing the water it now has under license."

Monopolistic practices and violation of Federal laws relating to licensing of power operations are charged by W. H. Walker, assistant general counsel for the Federal Power Commission, allegedly "being a party to a combination, agreements, arrangements or understanding, expressed or implied, to limit the output of electrical energy, to restrain trade, to fix, maintain and increase prices for electrical energy and service."

It was further insisted that "this monopolization of applicant's power for large preferred industrial consumers has resulted in limiting the output, maintaining and increasing prices to residential and small commercial consumers."

The company defended its present program and stated, in filed brief, that the concession to large power users had been a factor in building commerce in the region.

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Views on Financing by Utilities Sought

In an attempt to meet some of the objections of utilities to SEC procedure in filing and approving issues of securities, the commission has solicited utility executives and governmental regulatory commissions for technical advice in drawing up a "less burdensome and more adequate rule" to maintain competitive conditions in the distribution of utility securities.

The commission is seeking the views of executives of registered utility companies, state utility commissions and other regulatory authorities, investment bankers and dealers, and banks and insurance companies.

A great deal of criticism has been leveled at SEC for its delay in discussions over "arms-length bargaining" in the issuance of securities. The SEC now asks the interested parties for a method by which provisions of the utility act can be preserved and yet facilitate financing.

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Eight Get Coffin Award

Eight college graduates have been granted Charles A. Coffin fellowships, totaling $5,000 for use in carrying on advanced scientific research during the next school year. The students will carry on their work in different educational institutions—two at Stanford University and one each at Johns Hopkins, Michigan, Wisconsin, Rochester, California and Harvard universities.

MEETINGS

Edison Electric Institute—Annual sales conference, Edgewater Beach Hotel, Chicago, March 18-21; technical committees, Edgewater Beach Hotel, Chicago, Ill., May 6-9; annual convention, Atlantic City, N. J., June 2-6.

Oklahoma Utilities Association — Annual convention, Biltmore Hotel, Oklahoma City, March 18-19. Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City.

Missouri Valley Electric Association—Rural sales conference, Kansas City, Mo., March 19-20; engineering conference, Kansas City, Mo., March 21-22.

Association of Iron and Steel Engineers—Spring engineering conference, Cincinnati, Ohio, April 1-2. Brent Wiley, managing director, Empire Building, Pittsburgh, Pa.

Maryland Utilities Association — Spring meeting, Lord Baltimore Hotel, Baltimore, Md., April 5. J. H. Purdy, secretary, Lexington Bldg., Baltimore, Md.

Midwest Power Conference — Palmer House, Chicago, Ill., April 9-10.

Northwest Electric Light and Power Association—Engineering and operation section, Davenport Hotel, Spokane, Wash., April 10-12; Accounting and business practice section, Benson Hotel, Portland, Ore., May 23-24. Berkeley Snow, executive secretary, 707 Spalding Bldg., Portland, Ore.

Missouri Association of Public Utilities — Annual convention, Elms Hotel, Excelsior Springs, Mo., April 17-19. Jesse Blythe, assistant secretary, Merchants Bank Bldg., 101 West High St., Jefferson City, Mo.

Electrochemical Society — Spring meeting, Galen Hall, Wernersville, Pa., April 24-27. Dr. Colin G. Fink, secretary, Columbia University, New York, N. Y.

American Society of Mechanical Engineers — Spring meeting, Worcester, Mass., May 1-3. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

Southeastern Electric Exchange — Annual conference, Hotel Roanoke, Roanoke, Va., May 9-11. J. W. Talley, executive secretary, 308 Haas-Howell Bldg., Atlanta, Ga.

National Fire Protection Association — Annual meeting, Atlantic City, N. J., May 6-11. Robert S. Moulton, technical secretary, 60 Batterymarch St., Boston, Mass.

National Electrical Manufacturers Association — Spring meeting. The Homestead, Hot Springs, Va., May 12-17. W. J. Donald, managing director, 155 East 44th St., New York.

National District Heating Association — Annual meeting, French Lick Springs Hotel, French Lick, Ind., May 14-17. John F. Collins, Jr., secretary-treasurer, 1231 Grant Building, Pittsburgh, Pa.

National Electrical Wholesalers Association—Annual convention, The Homestead, Hot Springs, Va., May 19-23. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

Pacific Coast Electrical Association—Annual convention, Hotel Oakland, Oakland, Calif., May 22-24. Harold O. Noack, Hubbard & Co., Oakland, convention chairman.

American Society for Testing Materials—Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 24-28. R. E. Hess, assistant secretary, 260 South Broad St., Philadelphia, Pa.

Seek Ways to Gain Increased Net Load

Build load that will produce net revenue, V. H. Moon of the Central Service Corp., Chicago, told the approximately 300 delegates to the fifteenth annual meeting of the business development section of the Northwest Electric Light and Power Association at Seattle last week. He showed by analysis how it was sometimes more profitable from the "net" standpoint to add load that earned a gross of 3 cents per kilowatt-hour than load earning a gross of 5 cents, thus bringing out the necessity for analyzing proposed load-building programs. This is the way the sales manager can help the general manager meet his problems of management, he said.

In welcoming the delegates, Samuel P. MacFadden, vice-president of the Puget Sound Power & Light, outlined his company's dealings with the public utility districts that have instituted condemnation proceedings against the company looking toward the purchase of the company's properties in their respective districts. We will deal with the PUD's only if they drop their condemnation suits, he said.

J. E. E. Royer, vice-president, Washington Water Power Co., Spokane, and president of the association, pointed out the many fields for load development and the potentialities of each, and urged that particular stress be placed on securing new industries for the region.

Speaking on the value of a home service department to the utility, Ralph E. Gale, sales manager Idaho Power Co., pointed out the numerous rate reductions in the territory, and emphasized the necessity of getting the customer to make more use of his present equipment to make up this lost revenue. A well-trained home service department can do more to secure this increased revenue than any other division of load-building operations, he said.

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Virginia Utility Contract

A contract to cover construction of the foundation and building for the new $2,000,000 addition of the Virginia Public Service Company's steam generating plant in Alexandria has been awarded to the firm of Doyle & Russell of Richmond. The contract is for $350,000 and covers pilings, foundation and the concrete and brick building. The contract also includes the cost of installing the new machinery. Work will begin immediately and the plant will be in operation by next fall.

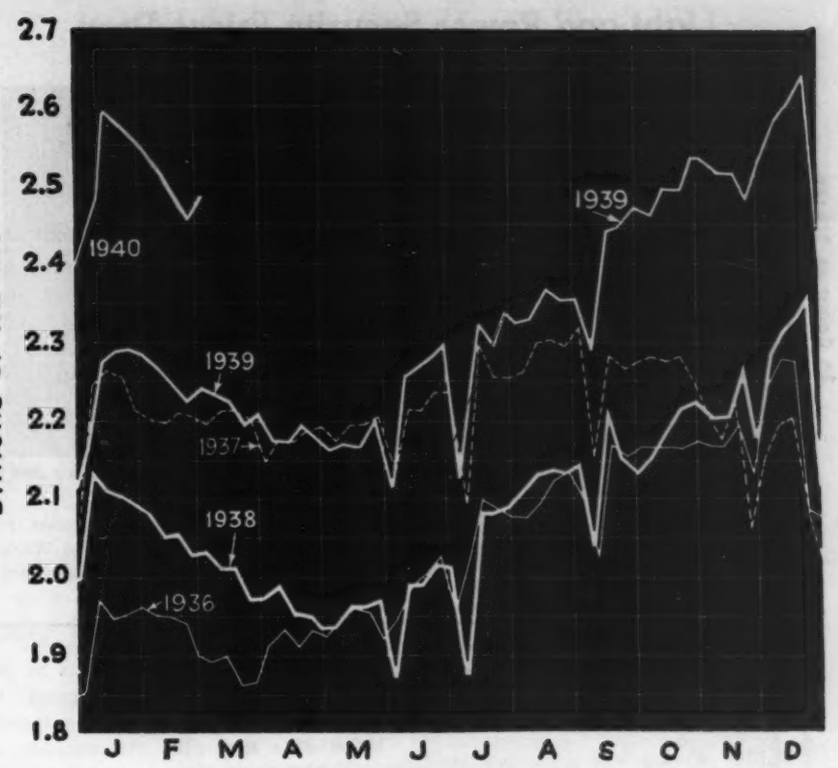
Output Turns Upward 10.5% Over Year Ago

With a rise that more than balanced the preceding week's decline and that marked the first reversal of the downward movement in progress since the middle of January, the output of the electric light and power industry during the week ended March 2 set a new record for this season of 2,479,036,000 kw.-hr., according to the Edison Electric Institute. The excess over the corresponding period a year ago increased slightly, to 10.5 per cent.

The margin over 1938 widened to 21.7 per cent, compared with 20.8 per cent a week ago, and over 1937 it rose to 12.7 per cent. The new figure also points to an improvement in the seasonal movement compared with recent weeks.

Using the preceding winter peak as a reference point, the decline now amounts to 6.1 per cent, which may be compared with corresponding figures of 7.5 per cent in 1938, 5.0 in 1939 and 3.4 in 1937.

Regional gains over 1939 generally increased, notably in the Rocky Mountain area, but also in the eastern and central industrial. Others decreased moderately.



Weekly Output Millions Kw.Hr.

1940		1939		1937*	
Mar. 2	2,479	Mar. 4	2,244	Mar. 6	2,200
Feb. 24	2,455	Feb. 25	2,226	Feb. 27	2,207
Feb. 17	2,476	Feb. 18	2,249	Feb. 20	2,212
Feb. 10	2,523	Feb. 11	2,268	Feb. 13	2,200
Feb. 3	2,541	Feb. 4	2,287	Feb. 6	2,201
Jan. 27	2,566	Jan. 28	2,293	Jan. 30	2,215

*1937 was high year prior to 1939.

Per Cent Change from Previous Year

	Week Ending		
	Mar. 2	Feb. 24	Feb. 17
New England	+ 8.4	+ 7.0	+ 5.2
Middle Atlantic	+ 9.0	+ 7.4	+ 7.2
Central Industrial	+13.9	+12.5	+12.9
West Central	+ 8.0	+ 9.7	+ 9.9
Southern States	+ 8.0	+10.9	+11.2
Rocky Mountain	+19.4	+16.6	+15.1
Pacific	+ 6.1	+ 7.2	+ 7.4
United States	+10.5	+10.3	+10.1

December Sales Rise 11.2%; Revenue 4.7%

Surpassing the record figure of a year ago by 10.4 per cent, the output of energy by the electric light and power industry in December rose to 11,307,315,000 kw.-hr., according to the Edison Electric Institute. This was 3.1 per cent more than in November, for which month figures were published in the ELECTRICAL WORLD of February 3, page 15.

Effects of the drought are reflected in the relatively small production from water power, 2,758,649,000 kw.-hr., down 22.4 per cent compared with December, 1938, and correspondingly large production from fuels, 8,548,666,000 kw.-hr., up 27.8 per cent. Hydro constituted only 24.4 per cent of the total, as against 34.7 per cent a year ago.

Sales to ultimate consumers were 11.2 per cent more than a year ago. The corresponding gain in November was 14.2 per cent. Revenue from customers, $206,238,800, shows an increase of 4.6 per cent, while total revenue, including other electric revenue, $208,514,100, was up 4.7 per cent.

For domestic service the average per customer for the twelve-month period has risen to 900 kw.-hr., with an annual bill of $36.54 and an average rate of 4.06 cents per kw.-hr. Corresponding figures for the like period a year ago were 853 kw.-hr., $36.08 and 4.23 cents, respectively.

Classification of Sales, December, 1939, and Increase Over 1938

Class	Million Kw.-Hr.	Per Cent
Residential or domestic	2,000	+ 8.3
Rural (distinct rural rates only)	*	*
Commercial & Industrial		
Small light and power (retail)	1,862	+15.2
Large light and power (wholesale)	4,925	+13.7
Public street and highway ltg.	203	+ 4.9
Other public authorities	205	— 6.0
Street and interurban railways	361	— 8.0
Electrified steam railroads	171	+10.6
Interdepartmental	33	+22.2
Sales, ultimate consumers	9,760	+11.2

*Allocated to other classes.

Labor Board Order

The NLRB has directed Indiana & Michigan Electric Co., South Bend, Ind., to disestablish Michigan Electrical Utility Workers Association as a collective bargaining representative for any of its employees.

High Court Will Review Appalachian Power Case

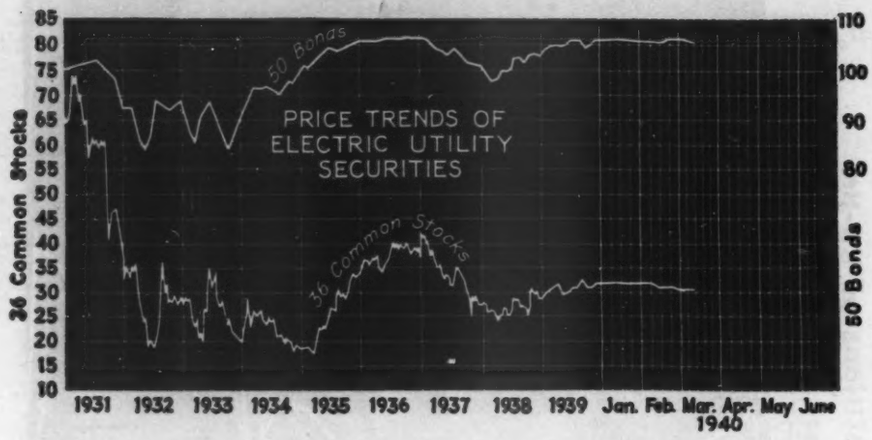
The U. S. Supreme Court has agreed to review a decision by the Circuit Court of Appeals holding that the Appalachian Electric Power Co. did not need a federal license to build a power dam on the New River near Radford, Va. The Circuit Court last November confirmed a lower court decree dismissing the complaint of the Federal Power Commission against the company for having refused to apply for a license.

Argument on the case is not expected to be heard by the Supreme Court until some time in April. The exact date has not been set by the court.

Wins Rural Line Decision

New Mexico Supreme Court has ruled that the Farmers' Electrical Membership Corp. of Curry County was not responsible for induction interference in telephone lines parelleling its distribution system. The opinion reversed a decision of the Curry County District Court.

Light and Power Security Prices Drop


50 Bonds
PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
36 Common Stocks
36 Common Stocks
50 Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1931 1932 1933 1934 1935 1936 1937 1938 1939 Jan. Feb. Mar. Apr. May June 1940

Application by the SEC of the "death sentence" to utility holding companies put utility securities under pressure. Losses were sufficient to carry the "Electrical World" stock index down from 31.4 to 31.0; last year, 31.8; bonds, 106.0; last week, 106.1

Kentucky Offerings Placed on Market

Public offering was made last week of $20,000,000 Kentucky Utilities Co. first mortgage bonds 4 per cent series of 1970, at 102 and interest, and $6,000,000 of 4½ per cent sinking fund mortgage bonds, due February 1, 1955, at 101½ and interest.

As originally filed for registration in December, the new financing of Kentucky Utilities Co. provided for a single issue of $26,000,000 first mortgage bonds due 1970. The registration statement was amended to cover the recent offering.

Proceeds from the sale of these bonds and from $6,000,000 of serial bank loans supplementary to this financing will be used to refund $27,003,825 of outstanding 5 per cent, 5½ per cent, 6 per cent and 6½ per cent bonds of Kentucky Utilities Co. and $4,266,775 of 5 per cent bonds of a recently acquired subsidiary, Lexington Utilities Co. and a subsidiary of the latter company.

SEC had approved the new securities after its parent company, the Middle West Corp., had agreed to make a $500,000 capital contribution to it.

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Withdraws Security Issues; Studies New Financing

Philadelphia Electric Co. management is studying various new plans for raising money to supplant the recently withdrawn $15,000,000 private sale to insurance companies.

When the original proposal was withdrawn last week decision on it had been pending before the SEC which had taken a critical attitude as to the company's depreciation program in hearings on the plan. Pending formulation of a new plan the company is continuing to finance on a short-term basis with bank loans being extended.

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Middle West Units File Consolidation Program

SEC has announced that Central and Southwest Utilities Co. and its subsidiary, American Public Service Co., have filed declarations and applications under the Holding Company Act in connection with the proposed consolidation of the two companies into a new corporation to be known as Central and Southwest Corp.

A declaration was filed covering the issuance of 188,709 shares of 5½ preferred stock and 1,041,274 shares of common stock of the new corporation, which are to be issued in exchange for the outstanding shares, including all dividend arrearages of Central and Southwest Utilities Co. and American Public Service Co.

Central and Southwest Utilities Co. owns 99.72 per cent of the common stock of American Public Service Co., it is stated, and this stock will be cancelled upon consummation of the consolidation. The balance of the outstanding stock, consisting of 268 shares, is held by the public.

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Two Slated for Board

The annual proxy statement of the Commonwealth Edison Co., forwarded to shareholders recently, shows that Charles Y. Freeman, chairman of the board, and Edward J. Doyle, president, are being proposed for election to the utility's board of directors to fill the vacancies created by the deaths of James Simpson and John T. Pirie. The annual meeting of stockholders will be held in Chicago on April 2.

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Utility Proposals Registered with SEC

Southeastern Electric & Gas Co. has filed with the SEC a plan covering a merger with its subsidiary, the Eastern Power Co., whose assets are to be acquired. The parent is to assume the liability of a note for $3,350,000, issued by the subsidiary to the Chase National Bank. It already owns all of the subsidiary's outstanding common stock and on completion of the merger the smaller company will be eliminated from the system.

SEC has issued an order approving the application of the New Bedford Gas & Edison Light Co. to issue and sell privately to New England Mutual Life Insurance Co. at par plus accrued interest $500,000 unsecured notes second series 3 per cent due 1955. Net proceeds are to be used to discharge floating indebtedness.

General Water, Gas & Electric Co. has filed a declaration covering the issuance of an $800,000 secured promissory note, 2½ per cent, to American Trust Co. and an $858,000 five per cent promissory note to International Utilities Corp., the parent company.

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Associated Units to Merge

SEC has announced that Associated Utilities Corp. has filed an application under Section 11(e) of the Holding Company Act for approval of a plan of merger of two of its subsidiaries, Associated Investing Corp. and Associated Real Properties, Inc. Associated Utilities Corp. is a subsidiary of Associated Gas & Electric Corp. The company proposes to acquire all of the assets of the two subsidiaries and assume their liabilities.

Utility Reports

	Net Income 1939	1938
*Carolina Power & Light..	$2,224,069	$2,504,398
*Connecticut Light & Power	4,168,872	3,853,919
*Dallas Power & Light....	1,604,229	1,600,637
*Duquesne Light	10,328,513	8,931,327
*Florida Power & Light..	1,428,709	2,039,591
*Houston Lighting & Power	2,786,428	2,977,318
*Kansas Gas & Electric...	1,191,532	1,255,498
*Montana Power and subs.	3,249,830	2,546,580
*New Orleans Public Service	1,947,072	1,567,752
*Texas Electric Service...	1,374,421	1,178,444
*Texas Power & Light....	2,272,544	1,971,146
*Wisconsin Public Service and subsidiary	1,648,392	1,359,341
	1940	1939
†Commonwealth & Southern and subs.	$13,499,459	$10,586,566

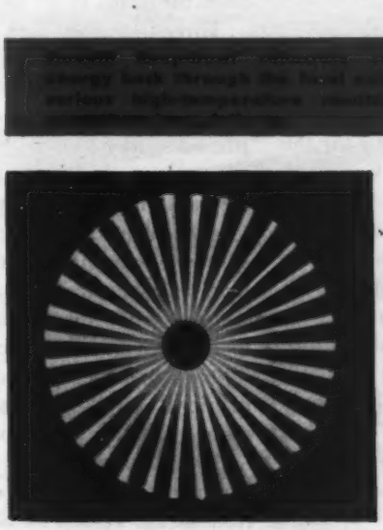
*Twelve months ended December 31.
†Twelve months ended January 31.

We STEPPED the Reflector and Reduced Lamp-stem Temperatures 278° F

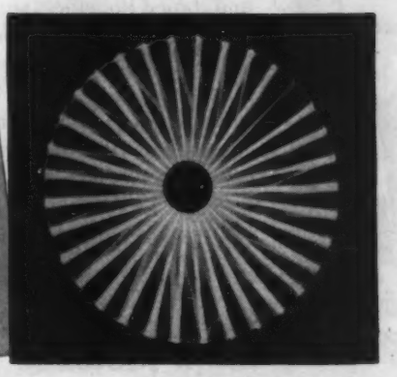
One Reason Why You Should Prefer the Form 79 Luminaire

Only General Electric offers this stepped reflector—the lamp-saving feature that made possible deep-bowl reflectors of inherently high efficiency in properly directing light to the pavement without objectionable glare. Smooth circular reflectors must reflect the radiant energy back through the focal axis of the lamp, and this concentration of energy causes short lamp life. G.E. overcame this serious high-temperature problem with a paraboloidal-ellipsoidal reflector and 48 offsets that redirect light rays around the focal axis. Tests show that lamp-stem temperatures in the Form 79 luminaire are 278 deg. F cooler.

And this G-E improvement costs you no more. It is one of the ten extra features available at no extra cost. Investigate the possibilities of using this luminaire for more attractive, more economical lighting. Just call the nearest G-E office or write General Electric, Schenectady, N. Y.



Photograph of the light distribution in a horizontal section through a luminaire with smooth reflector. Rays of light coming from the lamp are reflected back along the same path through the focal axis.



Rays of light coming from a Form 79 reflector, which is stepped with vertical flutes, are reflected slightly to one side of the focal axis and lamp stem.

ONLY THE FORM 79 HAS 10 EXTRA FEATURES AT NO EXTRA COST

1. Stepped (lamp-saving) reflector
2. Spun-sealed globe holder
3. Reconditioned reflector exchange
4. Durable Glyptal finish
5. Machined joint between hood and reflector
6. Die-cast aluminum hood
7. Heavier pressed globe with chip-proof edge
8. Larger ornamental globe (optional)
9. Available for Type H mercury lamps
10. Choice of three globe holders

GENERAL ELECTRIC

452-1

OPERATING PRACTICES

Lower Conduit With Hoists and Blocks

By E. F. NUEZEL
Superintendent Cincinnati Gas & Electric Company, Cincinnati, Ohio

A street resurfacing and grading job recently made it necessary for the Cincinnati Gas & Electric Company underground department to lower a 250-ft. section of four-duct conduit system with four 13,200-volt cables about eighteen inches. Since the cables connected a power station with an important industrial substation, the system had to be lowered while all of the cable remained in operation.

This job might have been done by supporting the system on ice; the

Chain hoist and safety blocks support conduit system as it is lowered

entire system with the cables would drop into the new position as the ice melted. In this instance the weather was not warm enough to insure melting of the ice within a reasonable length of time and the idea of thawing the ice with salt was discarded because of the corrosion hazard the salt introduced by coming in contact with the lead.

Three-ton chain jacks were used to support and to lower the cable. These were spaced approximately 6 ft. apart. In addition, wood blocks were placed under the system as it was lowered, so that had a slip occurred the cable would not have fallen more than an inch. Dry mixed concrete was spread on the new grade to be occupied by the system and as the lowered sections went into place they seated themselves in this support. The conduit system between manholes was originally built in the form of an arch so as to drain from the middle to both manholes. For this reason it was necessary to take out short sections of the system because in its ultimate position it would have a shorter length than in the original position.

After the system had been lowered in its new position split fiber ducts were installed over the cables and taped together so that the new concrete envelope could be restored without getting concrete back into the ducts.

No rubber gloves or other safety equipment were used in handling the energized cables because any break in the 13.2-kv. cables would have rendered such equipment ineffective.

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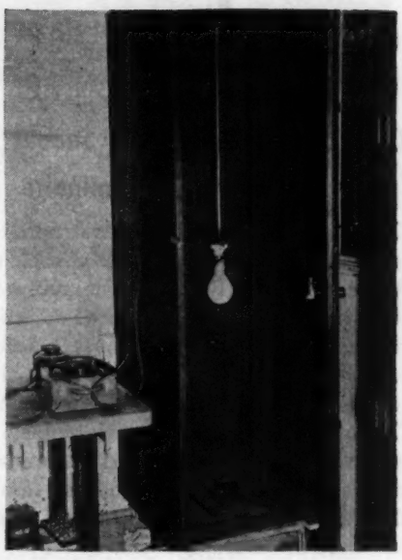
Light Meter Checking Device

Light meters of different makes may give slightly different readings under the same light conditions. Properly adjusted meters, however, will read exactly the same under a



Compartment for testing light meters under standard conditions

standard lamp with a filament operating at a temperature of 2,700 deg. K. To test and adjust the variety of meters used on their system under this standard condition engineers at the electrical laboratory of the Consumers Power Company, Jackson, Mich., built the illustrated test compartment.

In this compartment a standard lamp, which gives 2,700 deg. K. when operating at 95 volts, is suspended from the top of the compartment and provided with means for a height adjustment to give a range of illumination values on the top of the test meter, located on the floor of the compartment directly under the lamp. The lamp is connected to a steady source of a.c. through an auto-transformer that provides a means of adjusting lamp voltage.

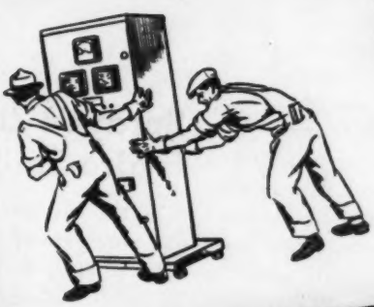
During the test the door of the compartment has to be closed to exclude extraneous light. The light meter

Memo to Power Salesmen:

THIS is one of a series of G-E advertisements appearing currently in several industrial trade journals to tell plant operating men of the many advantages of G-E midget metal-clad switchgear, which is now available at a considerable reduction in price. We know you will be interested because of your concern in seeing that your customers have the best possible protection for their incoming lines, power feeders, and motor circuits. Our switchgear specialists will be glad to assist you in bringing to your customers' plants the advantages of this high-quality equipment.

Now

You Can PLAY SAFE at LOW COST



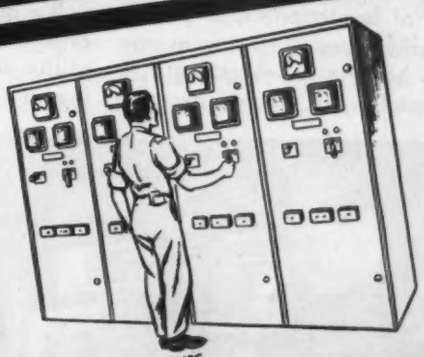
We've Reduced the Price of G-E Midget Metal-Clad Switchgear

for Protection of Circuits 600 to 5,000 Volts*

*Such as incoming lines, power feeders, and motor circuits

High-Quality Equipment for the Low-Price Field

Completely metal-enclosed — NO HAZARD TO PERSONNEL
Removable breakers — EASY MAINTENANCE
Liberal insulation — SERVICE CONTINUITY
Co-ordinated circuit components — BALANCED DESIGN
Sturdy mechanical interlocks — SAFETY FOR OPERATORS
Self-contained control — REDUCED STATION COST
Factory-built complete — A TESTED, FINISHED JOB
Shipped assembled — LOW AND PREDICTABLE INSTALLATION COST
Choice of colors — ATTRACTIVE APPEARANCE



Write for GEA-9249C. Get complete information.

GENERAL ELECTRIC

890-97

890-100

scale is read through a "peek hole" in the closed door. Opposite the "peek hole" in the door a prism directs the line-of-sight downward to a mirror opposite the meter on the floor of the compartment so that it can be read conveniently, without stooping, while the compartment door is closed.

•

Radio for Emergency Dispatching

By GEORGE A. GRIMM
Chief Load Dispatcher
Indiana Service Corporation, Fort Wayne

Spread over fourteen counties in northern Indiana, with headquarters in Fort Wayne, the Indiana Service Corporation has long felt the need for some form of rapid communication with emergency line crews and service cars to speed up company response to emergencies where a potential menace to public property or public safety existed. Ultra-high-frequency two-way space radio offered a means of prompt communication in such situations and was put into operation by the company under federal license in November, 1939.

The main transmitting station was placed at the load dispatcher's headquarters in Fort Wayne and both transmitter and receiving equipment were controlled from the office of the customer service supervisor, located about 1,000 ft. from the load dispatcher's office. The terrain to be covered, within the radius of about 18 miles of headquarters, is practically flat, headquarters being in one of the few hollows. A field strength of approximately 30 microvolts per meter was found sufficient for establishing main station to mobile service. Receivers that would give satisfactory results on 15 microvolts per meter only were considered. The main station antenna height was calculated to be approximately 200 ft. and a steel supporting tower capable of withstanding a 100-mile-an-hour wind against 1½ times the projected face with 50 per cent stress was obtained. The tower was anchored to the roof directly above the dispatcher's office, allowing the transmission line to be brought directly from the radiator into the transmitter.

Using minimum amount of power in the main station transmitter, 50 watts output was found to be sufficient, and it was determined that 25-watt mobile units installed in the heavy emergency trucks which operate on the outside limits would insure satisfactory transmission. Customer service trucks, which were not required to operate in these limits, were equipped with 10-watt mobile units. The antenna system adopted consisted of a coaxial type of radiator connected to the main transmitter through a ⅞-in. coaxial transmission line. The transmission line is filled with dry nitrogen gas carried under pressure of approximately 10 lb. to insure a dry line. As it was found that there is considerable difference in the amount of radio-frequency loss on coaxial transmission lines of different manufacture, the best obtainable line with the lowest radio-frequency loss should be used.

We decided upon the 39,860-kilocycle channel because a neighboring utility company was already operating on 31,460 kilocycles. The antenna was cut to match either the 39,660 or 39,860 kilocycle channels. Interference from automobile ignition was not appreciably different and there was no atmospheric disturbance on any of the frequencies.

While the equipment was being installed, classes of instruction were held to train the operating personnel to conform with the rules of the FCC in obtaining "Restricted Radio Telephone Operator's Permits." We devised a station log to form a better record of our own station and which meets the FCC requirements in showing the time and nature of each transmission from the main station or any of the associated mobile units.

Reliable communication has been carried on under all kinds of atmospheric conditions, and the equipment has been used on numerous occasions during high winds where limbs of trees had torn down the conductors, and any number of highway accidents and fires where danger was imminent. We are satisfied with the results of the ultra-high-frequency equipment and hope that when more experience is gained to be able to increase appreciably its beneficial use.

•

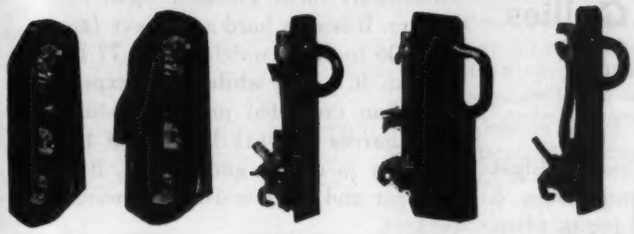
Sprayed Zinc Protects Hydro Spillway Gates

Extremely good results from spraying zinc onto spillway gates were reported at a recent meeting of the hydraulic power committee of the Pennsylvania Electric Association by J. F. Bodine of Susquehanna Electric Company. Two and a half years ago

From load dispatcher's desk author uses the two-way radio to direct a line crew to scene of emergency

At the scene the line foreman reports to headquarters over the two-way equipment in the truck cab

WE'VE BEEN TELLING YOU THIS—



50 amp 5 kv | 50 amp 7.5 kv | 50 amp Single-element | 50 amp Two-element reclosing | 100 amp Disconnect

2 HOUSINGS AND 3 DOORS MEET 80% OF YOUR CUTOUT REQUIREMENTS

Now FOR THE OTHER 20%

—here's a 100-ampere line with a new 2-element reclosing door

As long as we have been in the cutout business, we've never been able to offer a better, more complete line of enclosed, expulsion-type, fuse cutouts—and doors that are interchangeable, which makes possible true flexibility of cutout application.

The G-E 100-amp line—now made complete with a 2-element reclosing door—enables you to cut costs still further, by lower inventories, and fewer parts to handle in the stock room and on your trucks. Now, you can get a single-element door or a 2-element reclosing door or a disconnect door—all in both the 50-amp and 100-amp lines.

Two housings and three doors is General Electric's way of helping you cut costs through flexibility of cutout application. The new 100-amp recloser is completely described in a new supplement to bulletin GEA-2707. Ask our nearest sales office for a copy. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

an experiment was made at Conowingo by spraying an area of 160 sq.ft. on the upstream face of one of the gates with 0.010 in. of zinc. Results to date have been good. The estimated cost was slightly more than double the cost of a superlative paint job if both were done by company forces.

At Safe Harbor (as told by Paul A. Hess) 25 sq.ft. of sprayed zinc was applied to one of the gates five years ago and it is still perfect, even at the rivet heads. Subsequently the 2,000-sq.ft. face on the upstream side has been sprayed. The cost was about four times that of spraying on three coats of red lead, which is the preferred method of painting, no other paint being applied over the red lead. Sandblasting preparatory to spraying zinc has to be much more thorough than for painting and costs about three times as much. It has to be done a little at a time, so that only a few hours will elapse between blasting and spraying. Zinc spraying can probably be done by company employees at a total cost of about 30 cents per square foot.

"Greenheart" Poles Over Lowland Gullies

By HENRY B. SARGENT
Vice-President in Charge of Operations, Mississippi Power & Light Company, Jackson

When the Louisiana Power & Light Company and Mississippi Power & Light Company last fall began plans for a $1,250,000 addition to the 110-kv. "backbone" engineers were confronted with the problem of supplying unusually strong poles and timber which would be absolutely woodpecker-proof and yet more economical than steel structure. This problem led to experimental use of "Greenheart" poles.

Since the right-of-way for 5 miles to the line passed through hilly, wooded country near Natchez, Miss., where soil erosion caused numerous irregular gullies 50 to 100 ft. in depth, long ruling spans were necessary and structure sites were rather inaccessible. Search led to Georgetown, British Guiana, South America, where a tree (*Nectandra rodioei*) yielding poles known as "greenheart" grows in commercial quantities. Greenheart turns greenish upon exposure. It is very hard and heavy (sp. gr. 1.06 to 1.23; weighs 66 to 77 lb. per cu. ft.), and while more expensive than creosoted pine and somewhat harder to work because of the difficulty in curing and nailing, it is stronger and more resistant to woodpeckers.

Harder and Stronger

It is easily framed with ordinary hand tools, although it does break the screws of carpenters' bits quite frequently. The weight adds considerably to the cost of handling. Greenheart is about twice as strong in bending as the best longleaf yellow pine, and since the minimum Greenheart pole sizes available are much longer than yellow pine, they are about three times as strong as Class 3 longleaf yellow pine poles. This is a decided advantage, for a Greenheart H structure is approximately three times as strong in bending transversely and longitudinally as a Class 3 longleaf yellow pine H structure. A yellow pine H structure can be fitted with X braces to reinforce its transverse strength, but nothing can be done to increase its longitudinal strength, except by constructing guys, and these are objectionable, for the impulse insulation level is materially decreased.

The initial cost of Greenheart poles in the small quantities bought was about 50 per cent more than creosoted longleaf yellow pine poles of equal size. If bought in larger quantities—say at least 400 at a time—Greenheart would have an initial cost of about 25 per cent higher than yellow pine. The cost of Greenheart timber is about double that of creosoted yellow pine. A Greenheart H structure of equivalent longitudinal and transverse strength as that of a steel structure would cost approximately 65 per cent as much erected.

Further observation convinced us that though strong, straight and suitable for line construction, Greenheart —the native habitat of which is low, damp, almost swampy ground—should be used only in low altitudes, where climates of high humidity prevent drying and splitting. The experiment is comparatively young, and only time—with its unforeseen events —will establish the relative merits of Greenheart and creosoted yellow pine in transmission line construction.

Air Breakers Chosen for Station Auxiliaries

As an aid to increased safety, elimination of oil storage, piping and filtering and lessened inspection and maintenance expense, an Eastern utility has installed fifteen 2.5-kv. Westinghouse "Deion" air circuit breakers to control the 2,300-volt power house auxiliaries for a new Westinghouse 30,000-kw., 37,500 kva., 80 per cent p.f.d. 13,800-volt turbo-generator. The air breakers, which carry a 23,000-amp. interrupting capacity rating, are installed in the lower halves of fifteen steel cubicles with silver-contact disconnecting switches just above. Swing doors carry the controls and meters.

DON'T LET OTHERS GET THE JUMP ON YOU WHEN IT COMES TO MONEY SAVING IDEAS

If needless blows are causing shutdowns in your plant, why not be the first to recognize the service BUSS Super-Lag fuses can render you?

Needless blows caused by poor contact heating have practically been eliminated in BUSS Super-Lag fuses by a Fuse-Case design worked out through years of laboratory and actual field tests.

... and BUSS Super-Lag fuses have a time-lag feature that really does go a long way towards solving the shutdown problem when the shutdowns are being caused by fuses blowing on temporary or momentary overcurrents.

That's why users of BUSS fuses enjoy a freedom from costly interruptions of electrical service that formerly were so often a burden upon the shoulders of the executives in charge of production or maintenance.

How to get action

Just knowing about BUSS Super-Lag fuses doesn't save any money—unless the fuses are in your fuse clips. So why not get action that means money saving by passing the word along that from now on all fuses installed are to be BUSS Super-Lag fuses?

Your electrical wholesaler has or will get BUSS fuses for you ... Bussmann Mfg. Co., University & Jefferson, St. Louis. Division of McGraw Electric Co.

BUSS
10 FEATURES
in the design of the FUSE-CASE help make it possible..
SUPER-LAG
development in the FUSE-LINK completes the job.

FUSES

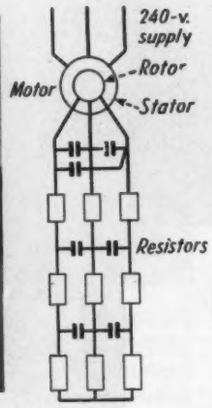
INDUSTRIAL ENGINEERING

Avoid Water Hammer by Decelerating Motors

By HAROLD FOX
General Electric Company, Boston, Mass.

A control layout designed to decelerate motors from full speed of 1,200 r.p.m. to full stop in four steps, taking about 20 seconds in toto, is an interesting feature of a recently completed sewage pumping station at East Saugus, Mass. The plant has two pumping units, each consisting of a 3 000-g.p.m. Morris-Knowles nonclogging centrifugal pump direct connected on a vertical shaft to a 75-hp. 240-volt, three-phase, 60-cycle general Electric slip-ring induction motor. The average head is 65 ft., and the prevention of water hammer on the piping in stopping either unit was important. About 900 gal. per kilowatt-hour are pumped from this plant into the adjacent Lynn system. Two 50-kva. transformers supply energy to the pump motors from the power system.

The decelerating control utilizes the pump motor starting resistors when shutting down, the contactor and relay installation cutting in resistor sections at intervals of three to seven seconds in the rotor circuit. The resistor terminals are connected to suitable terminals on the control panel of the dead-front switchboard of the plant, and thence to the several relays concerned for either automatic or hand operation. Fay, Spofford & Thorndike, Boston, were the consulting engineers.



Slip-ring pump motors at Saugus occupy little space; starting resistors are connected with switchboard control panel

•

Electronic Control for Resistance Welding

By E. H. VEDDER
Electronics Division, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Electronic control has become an important factor in such industries as the automotive, aircraft and rail car. Approximately 500 have been installed by Westinghouse because of their reduced maintenance and more accurate welding.

In the aircraft industry resistance welding is now recognized as reliable enough to use on stressed parts of wings and fuselage. Ignitron welding timers are used on the aluminum and stainless steels normally welded in aircraft. A sequence and protective panel provides "squeeze," "weld," "hold," and "off" times, combined with complete circuit and control protection. The sequence timers shown are mounted on the door, while the electrically operated breaker and disconnect switch are on the upper panel with small control breakers.

Sequence and protective panel for aircraft welding

A panel mounted electronic contactor has been developed for steel mill application. It includes heat control and thermostatically controlled cabinet temperature to avoid freezing of water in the tubes. This unit is rated 880 amp. continuous or 1,500 amp. for three seconds, 60 per cent duty or 2,800 amp. for 1.5 seconds, 30 per cent duty, or 3,300 amp. for 0.5 second, 10 per cent duty.

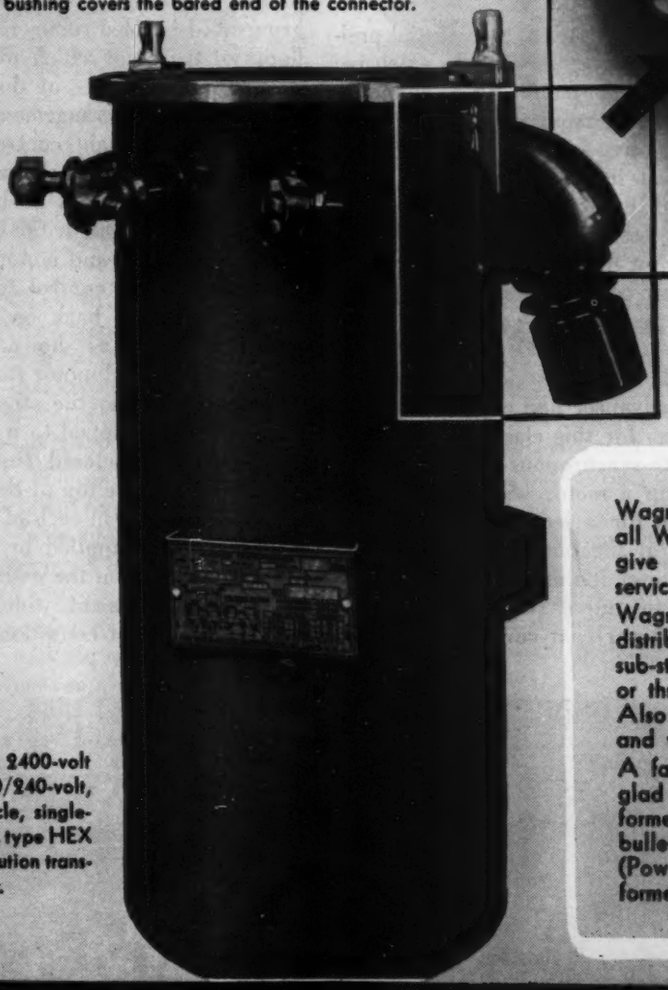
An OUTSTANDING FEATURE *of* WAGNER *Type* HEX TRANSFORMERS

The design and construction of the steel bushing pocket of the Wagner HEX transformer make it an outstanding feature.

A. One-piece copper-bearing steel bushing pocket electrically welded to the tank provides protection to the bushing.

B. The bushing is held in place by a positive clamping device. The clamping ring is locked into position by the coiled spring which fits into a groove in the bushing.

C. The terminal stud is set within the bushing so that a portion of the bushing covers the bared end of the connector.



3-Kva, 2400-volt to 120/240-volt, 60-cycle, single-phase, type HEX distribution transformer.

Wagner HEX distribution transformers, like all Wagner transformers, are designed to give efficient, dependable, uninterrupted service.

Wagner manufactures a complete line of distribution transformers for pole mounting, sub-station and sub-way types — single or three-phase, rural-line and air-cooled. Also power transformers in various sizes and voltages.

A factory-trained sales engineer will be glad to help you with any of your transformer problems. In the meantime write for bulletins TU-180 (Distribution) and TU-181 (Power) describing these Wagner Transformers.

T40-4

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

TRANSFORMERS · MOTORS · FANS · BRAKES

Balancing Device Proves a Time-Saver

To permit the successful balancing of rotating equipment to eliminate vibration without the removal of the rotor from the machine and the balancing of rotors that are too heavy for previously available portable balancing machines, General Electric has produced a portable dynamic balancing device. It has been found a time saver in balancing auxiliary equipment in central stations and manufacturing plants, as the number of trial runs required are reduced to a minimum of three, especially in those cases where balancing operations are necessary and trial-and-error methods are impractical.

The equipment consists of a sine-wave alternator, a vibration pickup and an indicating instrument for reading mils of displacement of the vibration. The sine-wave alternator spindle is inserted in a lathe center hole in either end of the rotor and the vibration pick-up is placed against the rotor bearing. The two voltages generated in the sine-wave alternator and vibration velocity unit are applied to the measuring instrument. The test is made with the machine in its original condition and then with two trial weights attached, and the final weights and their location to be applied to correct the unbalance are determined from the amount of vibration and the relative angular position of the high spot found.

This device is capable of measuring the amount and phase angle of unbalance vibration present in the bearing pedestals of a rotating machine running in its own or substitute bearings at any speed between about 600 and 5,000 r.p.m.

•

Modernization of English Brewery

Modernization and changeover in the Aston (Birmingham, England) brewery of Ansell's Brewery Inc., from d.c. to a.c. is about two-thirds completed, reports the *Electrical Review*.

The malt, required for processing, is first treated in torrefiers, slow rotating cylindrical drums through which hot air for drying is passed. The torrefiers have very large ratio speed reduction drives, with ammeters in the motor circuits. Since the introduction of the ammeters, troubles such as motor overheating, excess consumption and belt transmission difficulties have vanished.

The freshly torrefied malt is delivered to the mills for immediate grinding, 12-hp. 960-r.p.m. motors providing convenient drives for the mill speeds required. During fermentation rousing takes place about every two hours, allowing escape of CO_2 and bringing fresh air to the yeast. The rouser is a non-ferrous hollow cone open at the bottom and rotated at various speeds due to the varying heights and densities of the treated liquid. Motors for the rouser, $\frac{1}{3}$ hp. totally inclosed, $\frac{1}{4}$-hour rated d.c. machines with a speed variation from 420 to 720 r.p.m., are flange mounted to the roof girders and drive the cones by means of long steel shafts.

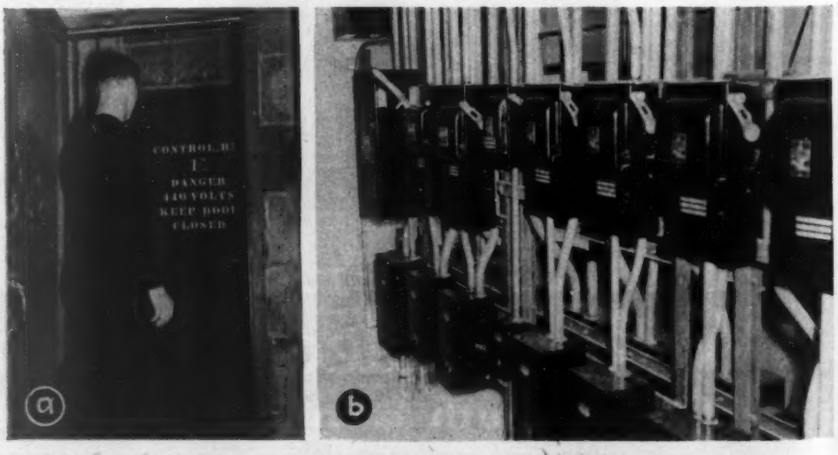
For conditioning, an essential prelude to bottling, there is an extensive refrigerating plant, with ammonia compressors requiring larger motors (with power factor correction) than are used individually in any other part of the brewery. The original scheme called for only about 37 and 50 hp. for the conditioning and chilling room compressors, with provision for increasing the capacity of each compressor by 100 per cent at a later date. It was decided that the phase advancer had considerable advantages for this class of work over the auto-synchronous motor, and by adopting a motor with an advancer suitable for a leading power factor of 0.5 at the outset with the lower horsepower it was found that the increase in output required up to the full 100 per cent could be obtained on the same motors though with less leading capacity at the highest load.

•

Dust-Tight Rooms for Corn Mill Controls

Corn mills, such as the one operated at Kankakee, Ill., by the General Foods Company for the processing of corn into flakes from which Post Toasties are made, come under Class II, group G hazardous locations, because of the presence of combustible grain dust. Electrical equipment in general, therefore, must be dust-tight to protect against the danger of explosion or fire. At the Kankakee mill the high cost of installing dust-tight safety switches and motor starters at or near driven machines was avoided by engineers when designing this new plant. All control equipment was grouped in isolated rooms on various floors of the plant which were made dust-tight by the use of double air-lock doors. This arrangement allowed use of non-dust-tight control equipment at a considerable cost and space saving. Only dust-tight push buttons are at the machines in the plant.

Safety switches and motor starting equipment in the control rooms are mounted back to back on channel-iron frameworks as shown. Related safety switches and motor starters are mounted one under the other on the framework and tapped to a common 440-volt, metal-inclosed supply bus that runs along the top of the control rack. These buses in each of the control rooms are supplied by separate feeder circuits from the main control room in the basement, which is also isolated from dust conditions.



Air-lock doors (a) with short corridor between keep dust out of control rooms, where motor starting equipment (b) is mounted on special racks

Fiberglas Insulated Motors Last as much as Three to Five Times Longer in Tough-Job Applications

ARE YOU HAVING TROUBLE with motors that need frequent rewinding? Would you like to get as much as *three to five times* longer life? Or virtually double the ability of your equipment to carry overloads without damage?

Very likely you *can*. A new discovery makes these things possible. A discovery that lengthens the life of many types of electrical equipment, almost beyond belief!

This discovery is Fiberglas* Electrical Insulation. And the reason that Fiberglas Insulation can give motors almost perpetual youth is because it is *tougher*. It is resistant to most of the common causes of motor deterioration.

Fiberglas Electrical Insulation is *pure glass in fibrous form*. It can resist heat as high as 1000° F. It is not harmed by excessive moisture. Cannot rot. And is more stable in the face of most chemical corrosion than copper or iron. So what's the result?

Motors of 5 HP, for instance, *made with Fiberglas Insulation*, have easily withstood 7½ HP loads with safety. Why? Because Fiberglas Insulation can stand the added heat. But you haven't heard anything yet.

Leading electrical manufacturers are turning out motors and generators with Fiberglas Insulation, that are smashing all records for rugged performance.

And now the best news of all! Fiberglas has saved its modest cost many times over because it cut repairs, increased life, and reduced "down time."

Prove It Yourself

Don't take all this on our say-so. Make an actual test in your own business. Next time you have a repair job, or order a new piece of equipment, specify Fiberglas Insulation. From then on, let the *facts* do the talking. It's 10 to 1 they'll say: Standardize on Fiberglas Insulation.

OWENS-CORNING

FIBERGLAS

*T. M. Reg. U. S. Pat. Off.

Any of the following firms can give you full information and quote prices on Fiberglas Electrical Insulation.

Allied Rubber & Mica Co.	Cleveland, Ohio
Earl B. Beach Company	Pittsburgh, Pa.
General Electric Company	Bridgeport, Conn.
Graybar Electric Company	New York, N. Y.
Gustin-Bacon Mfg. Company	Kansas City, Mo.
Insulation Incorporated	St. Louis, Mo.
Insulation Mfg. Company	Chicago, Ill.
Marwood, Ltd.	San Francisco, Calif.
Mica Insulator Company	New York, N. Y.
Mitchell-Rand Insulation Co.	New York, N. Y.
National Electric Coil Co.	Columbus, Ohio
Prehler Bros., Inc.	Chicago, Ill.
Westinghouse Elec. & Mfg. Co.	Trafford, Pa.
White Supply Company	St. Louis, Mo.

NEW ENGINEERING IDEAS

Telemetering Scheme for Generating Stations

By LUDWIG F. LISCHER
Junior Engineer
Commonwealth Edison Company, Chicago

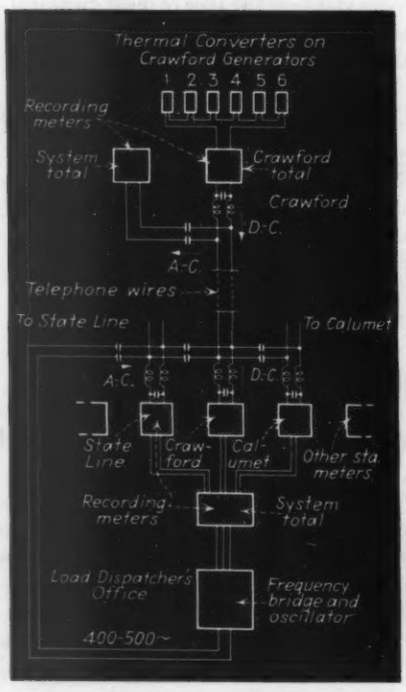
Simplicity, economy, accuracy and low maintenance are the advantages that can be claimed for the following scheme proposed as a method of giving station load indication at a remotely located dispatcher's office. The scheme calls for the installation on each of the generator leads in a station of a thermocouple which will generate an emf. proportional to the load on the machine. By connecting all the thermal converters in a station in series a d.c. voltage is obtained that is proportional to the total generation of the station. A pair of telephone wires is used as the transmission medium between the generating station and the load dispatcher's office.

In the load dispatcher's office is a voltage recorder to measure the potential generated by the thermocouples. The scale on this recorder is replaced with one calibrated in megawatts—as the power is directly proportional to the voltage of the thermocouples. The meter proposed employs a "null" method of measurement so that when the bridge is balanced no current flows over the telephone wires.

Readings of the meters are totalized in the load dispatcher's office, thus giving an indication of the total system generation. This is accomplished by the totalizing meter. It measures the summation of voltage drops across the slide wires of each of the station meters, each voltage drop being proportional to the generation indicated on that meter. In this way a simple, direct method is obtained that involves no mechanical totalizer with associated moving parts and relays.

For giving an indication of total system load from dispatcher's office to station a frequency scheme is proposed in which the frequency is proportional to the total generation. This permits the use of the same two wires for transmitting signals both ways.

In the back of the totalizing meter are a slide wire and a sliding contact which are part of a frequency bridge. To the shaft of the galvanometer of the bridge is attached a variable condenser which is in the circuit of an audio-frequency oscillator. As the load varies, changing the position of the contact on the slide wire, the galvanometer will move the condenser, thus varying the frequency until the bridge is again balanced, the resulting frequency being at all times proportional to the load. This might be called another "null" method, as the frequency is independent of the characteristics or position of the condenser. This permits the use of an ordinary variable radio-type condenser. Also, the varying characteristics of the oscillator have no effect on the accuracy for the frequency at all times must be such as to balance the bridge.



Two-way telemetering scheme indicates station and system load at each station and dispatcher's office

Another feature of the scheme is the ease with which a change may be made without discarding any equipment, permitting the control of the governors of the turbines in the station directly from the load dispatcher's office. This may be done by adding an automatic feature which will send "raise" and "lower" impulses. The trend in modern operating methods is toward such automatic control, and this can be made possible only by the combined features of reliability, accuracy and economy which are inherent in the described telemetering scheme.

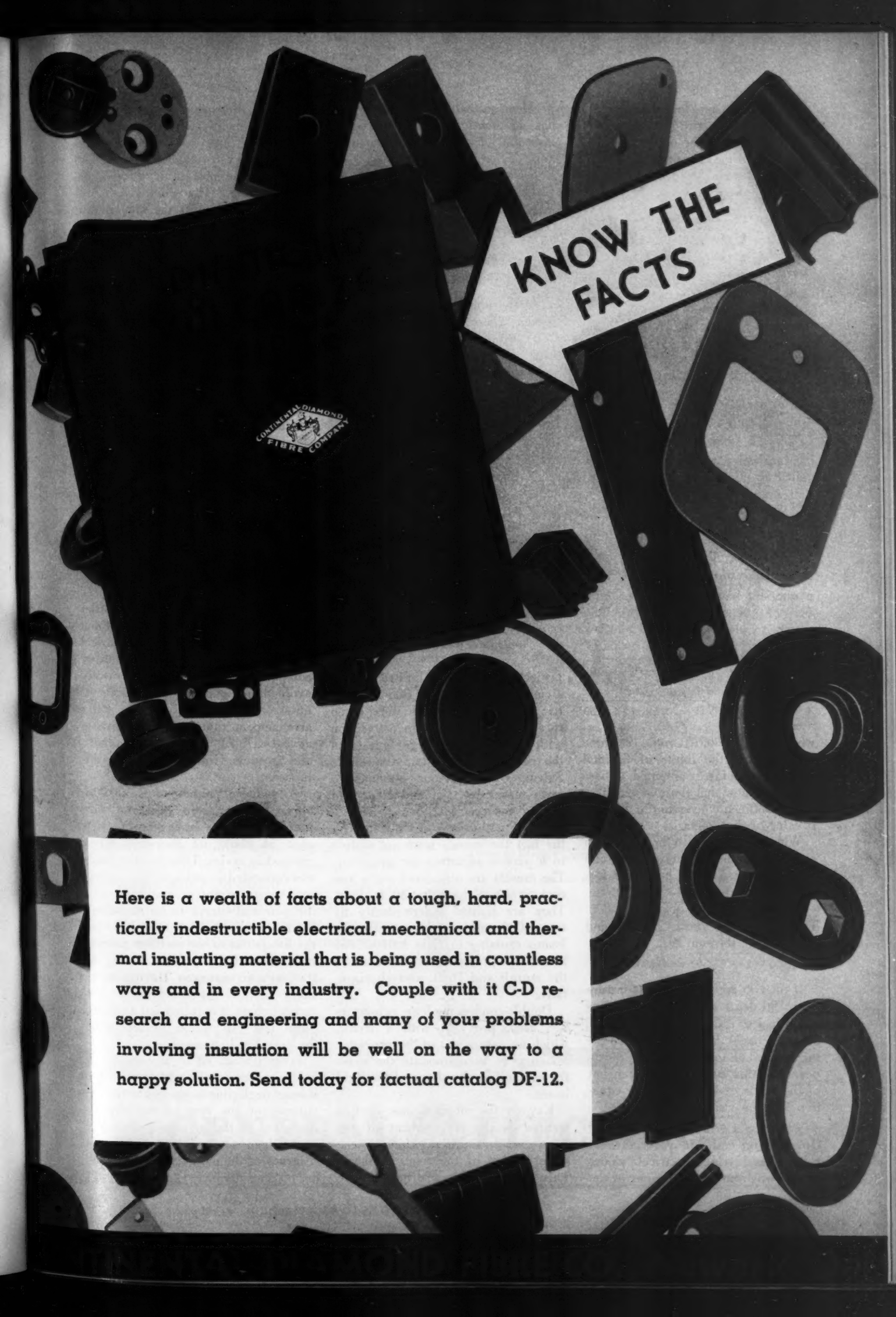
•

Fast Method Combines Voltage Vectors

By LAMAR LYNDON
Consulting Engineer, Los Angeles, Calif.

By employing a simple modification of the usual formulas for vectorially combining emf.'s, time, labor and the possibility of arithmetical error are all reduced.

For the summation of any emf.'s, as A and B, having a phase angle θ between them, it is usual to compute the X and Y values of each e.m.f. and the sum is then $\sqrt{X^2 + Y^2}$ (1), or, to use the direct geometrical formula, $A + B = \sqrt{A^2 + B^2 + 2AB\cos\theta}$ (2), both reducing to the same final formula. In high-tension transmission calculations where the voltage values are great, especially in working back from the load to the generator by successive steps, such inconvenient, odd values as 169,268, or the like, are encountered.



Here is a wealth of facts about a tough, hard, practically indestructible electrical, mechanical and thermal insulating material that is being used in countless ways and in every industry. Couple with it C-D research and engineering and many of your problems involving insulation will be well on the way to a happy solution. Send today for factual catalog DF-12.

Obviously, making the computations indicated, with such values, and for a large number of steps, is tedious and time consuming. But by merely changing B to its A value, or taking $\frac{B}{A} = K$, so that $B = KA$ (3), equation (2) becomes

$$\Sigma \text{ emf.'s} = \sqrt{A^2 + K^2A^2 + 2AKA\cos\theta} \quad (4).$$

Since A_2 appears in each factor the formula becomes

$$A + B = A\sqrt{1 + K^2 + 2K\cos\theta} \quad (5),$$

which eliminates squares of large quantities from the computations. For example, if A is 156,000 volts, B 27,900 volts and θ 30 deg., K is $\frac{27,900}{156,000}$ or 0.18; $K^2 = 0.0324$ and $\cos\theta = 0.866$, so that

$$A + B = 156,000\sqrt{1 + 0.0324 + (2 \times 0.18 \times .866)}$$

or 180,000 volts.

Manifestly, the same result is obtained by changing B into its A value. For $\frac{A}{B} = K_1$ the sum of emf.'s becomes

$$= B\sqrt{1 + K_1^2 + 2K_1\cos\theta} \quad (6).$$

By inspection it can generally be determined whether $\frac{A}{B}$ or $\frac{B}{A}$ gives a quotient having the smaller number of digits and, therefore, the easier to use in the calculations. Reversing in the foregoing example, $K_1 = \frac{A}{B} = \frac{156,000}{27,900} = 5.59$, and $K^2_1 = 31.248$, so that the sum

$$A + B = 27,900\sqrt{1 + 31.248 + (2 \times 59 \times .866)},$$

which equals 180,670 volts, the same result within the limits of decimal places, as before computed. These examples show that there is usually a choice between conversion of A to its B value or vice versa.

When the emf.'s to be combined are equal, as in polyphase work, and $A = B$, then $K = 1$, hence the formula reduces to:

$$A + B = A\sqrt{2 + 2\cos\theta}.$$

Thus, for $A = B = 227,500$ and $\theta = 60$ deg. the sum is

$$227,500\sqrt{2 + 2 \times 0.5} = 394,030 \text{ volts.}$$

If the two emf.'s are in quadrature ($\theta = 90$ deg.) the formula becomes

$$A + B = A\sqrt{1 + K^2} \quad (7),$$

because cos 90 deg. is zero, hence the third term under the radical disappears. In this case K is the tangent of the angle of lag ϕ, and the equation may be written

$$A + B = A\sqrt{1 + \tan^2\phi} \quad (8).$$

However, for emf.'s in quadrature all voltage and trigonometrical values are known from the conditions of the problem, so that the modification (8) has no practical utility and is here indicated merely to show the useful limit of the method.

•

Photos Solve Light Projection Problem

By E. R. FLETCHER
Portland General Electric Company, Portland, Ore.

Photographs taken with a camera placed where light projectors were to be installed proved to be a simple way of determining the shape of a light mask which was to confine the

Photograph taken from point where projector was to be installed. Distorted outline of the mural as it appears here gives the required shape of opening in the light-projector mask.

projector's beam to a limited area of a curved wall. Portland General Electric Company engineers were asked to solve this problem in connection with lighting four large murals in the rotunda of the state Capitol at Salem, Ore. Previous attempts to form masks by trial and error had proved unsuccessful.

The situation was complicated by the fact the murals were not visible to a person adjusting the projector. The murals are on curved walls and each is 10 ft. high by 30 ft. long. They are lighted independently by two 1,000-watt projectors each, the beams crossing to light half of one mural. The projectors are 33 ft. above the murals and 16 ft. away horizontally.

Double-condensing-lens projectors are used, provided with a frame, which fits into a slot of the projector housing, to accommodate the mask for controlling the shape of the light beam.

Key to the effective use of this method is the enlargement of the photograph to a size which is the same as that of the required mask. This was done by determining one typical dimension experimentally. That is, metal strips were used in the mask frame and adjusted so the beam would just extend from edge to edge of the mural along one convenient line. The photograph was then enlarged until the similar line was of the length required at the aperture.

The mural was then cut out of the photograph and the outline scratched on the mask with a scratch awl.

Unrelated to this problem, but of value, was subsequent experience with the durabilities of different sheet metals in this mask application where there was considerable heat. One 18-gage aluminum mask after 1,000 hours service showed no distortion or discoloration. One stainless-steel mask was free from scaling, but showed considerable discoloration and slight warping near the center.

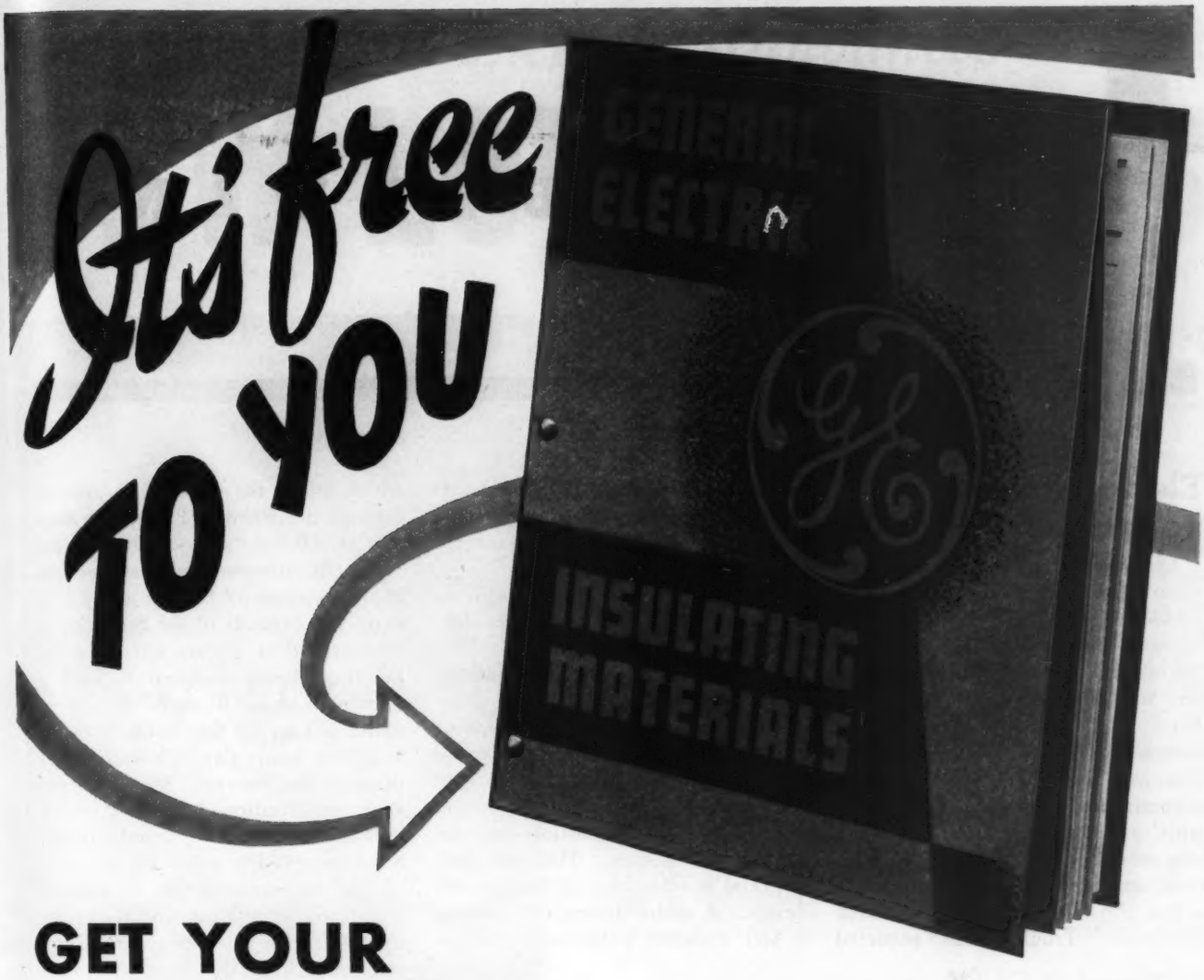
•

Use Simple Scheme to Measure 60 Kv.

In a test operation that required measurement of voltages of the order of 60 kv., accurate to within about 5 per cent, engineers at the electrical laboratories of a midwestern utility company, recently rather neatly avoided an elaborate and critical setup of sphere-gap equipment by an arrangement that has the desirable advantages of low-cost, simplicity and freedom from hair-splitting adjustment.

A sufficient number of 300,000-ohm, 10-watt radio resistors were purchased to give an aggregate resistance of about 67 megohms when chained in series. This resistor chain was connected in series with a copper-oxide instrument-type rectifier across the potential source to be measured. A d.c. millimeter connected across the d.c. points of the rectifier gave an indication of the current flowing in the series arrangement. Having previously checked the resistance of the resistor chain it required but a simple ohms law calculation to determine the potential impressed.

Error introduced by the resistance of the copper-oxide rectifier was considered negligible compared to the resistance of the rest of the circuit. Accuracy of the arrangement is acknowledged to be limited by the accuracy of the megger used to check the resistor chain.



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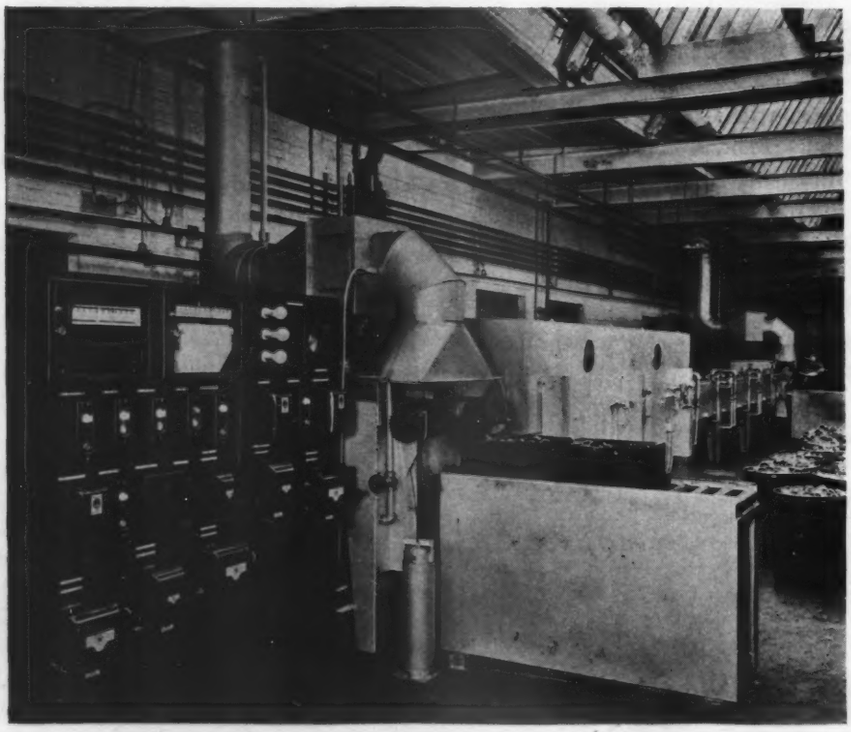
GENERAL ELECTRIC

LOAD BUILDING

Electric Annealing Forged Steel Unions

Close temperature control and uniform annealing obtained with a 90-kw. Westinghouse electric furnace recently installed at the Rockwood Sprinkler Company plant in Worcester, Mass., have proved highly beneficial in the manufacture of cold forged steel unions. These range from ⅛-in. pipe size to 3 in. and were formerly annealed in oil-burning furnaces without atmospheric control. Pickling was necessary under the old arrangement and annealing was required to soften the steel after each drawing operation. Trouble also occurred from scaling, and the production cycle was increased in time by slow cooling of the fuel-fired furnace equipment.

With the new furnace scaling is no longer a factor in the plant production and pickling has been eliminated. The furnace is approximately 52 ft. long and supersedes two oil-burning furnaces on an eight-hour per day basis. Atmospheric control is provided by burning city gas with air in a combustor and introducing the product of combustion into the annealing chamber. The processed material is scale-free; in fact, almost bright. A motor-driven ram (about ¾ hp) operates a hydraulic pusher which moves the material in process through a 1,300-deg. F. heating zone and 1,250-deg. second zone, after which it traverses a water-cooled cooling section 32 ft. long and a 3-ft. exit. The capacity of the first zone is 29 trays 18 in. square x 7 in. deep, the trays being designed to hold a maximum of 250 lb. each. At present about 175 lb. per tray is charged. In a sixteen-hour day 83 trays pass through the furnace. On a fifteen-year amortization basis the saving thus far per hundred pounds of material annealed is about 25 per cent. Should the power or gas supply fail a warning is sounded, and if the gas should fail the gas atmosphere equipment stops immediately.



90-kw. Westinghouse electric furnace in Worcester plant eliminates scaling, pickling and time delay in manufacture of forged steel unions

•

Long-Pull Results of Lighting Activity

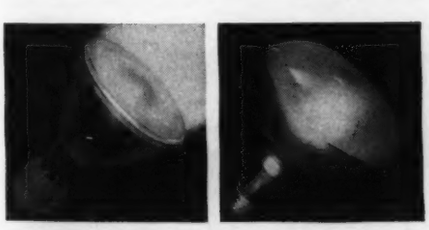
Revenue added at a cost of 47 cents per dollar is the average performance over a ten-year period of the lighting service department of the Consolidated Gas, Electric Light & Power Company of Baltimore. In the years 1929-1938 inclusive, according to a careful appraisal of the revenue-producing value of each installation, the lighting load increase accomplished by the department was 24,776 kw., representing an annual revenue addition of $1,075,120. The cost of maintaining the department, including everything appertaining to its regular operation, was $504,799. Extensive promotion of "Better Light—Better Sight" was carried on in addition to the regular functioning of the department in 1935, '36 and '37 at an expense for the three years of $55,595. Adding in this cost brings

General Electric Announces

NEW LOW PRICES

ON FLUORESCENT AND OTHER G-E MAZDA LAMPS OF IMPORTANCE TO BUSINESS AND INDUSTRY

G-E MAZDA *Fluorescent lamps are recommended for use only with equipment providing good power factor. The lamp to the left in the above photo is the T-8 size which is 1" in diameter... the other is a T-12 size which is 1½" in diameter.*



G-E MAZDA Projector lamps (left) combine reflector, lens, and 150 watt filament in one sealed-in unit. G-E MAZDA Reflector lamps (right) are for indoor use. Both lamps come in Spot and Flood types.

EFFECTIVE March 1, 1940, General Electric announces new low prices on G-E MAZDA F (fluorescent) lamps. Greater demand for these lamps has brought increased production. The resulting manufacturing economies are passed on to customers in the form of new low prices. Because of this policy of offering better and better MAZDA lamps at lower and lower prices, it pays to be sure that the lamps you recommend bear the G-E monogram.

NOTE: G. E. tells its customers: "Fluorescent lighting must be used correctly. There are many places where fluorescent lighting is ideal. Others where some other type of lighting may prove more desirable. Be sure to consult a qualified lighting expert who can assist you in getting the type of lighting you require."

General Electric Company, Nela Park, Cleveland, Ohio.

Fluorescent (Daylight and White lamps)

WATTAGE	BULB SIZE	WAS	NOW
15	T-8	$1.35	$1.15
15	T-12	1.70	1.45
20	T-12	1.90	1.65
30	T-8	1.85	1.50
40	T-12	2.70	2.30

Blue, Green, and Pink fluorescent lamps

15	T-8	$1.45	$1.25
15	T-12	1.80	1.55
20	T-12	2.00	1.75
30	T-8	1.95	1.60

Gold and Red fluorescent lamps

15	T-8	$1.55	$1.35
15	T-12	1.90	1.65
20	T-12	2.10	1.85
30	T-8	2.05	1.70

OTHER PRICES ALSO REDUCED. The 150 watt G-E MAZDA Projector lamp (both Spot and Flood types) is reduced in price from **$1.70 to $1.40.**

The 300 watt G-E MAZDA Reflector lamp (both Spot and Flood types) is reduced from **$1.90 to $1.70.**

Also effective March 1, 1940, General Electric announces price reductions on G-E MAZDA Lumiline lamps and certain high voltage lamps.

G-E MAZDA LAMPS
GENERAL ELECTRIC

YEAR BY YEAR, BETTER LAMPS FOR EVERY PURPOSE

Your "Annual Report"

On pages 71 to 78 of this issue of "Electrical World" we present your annual report of appliance and lighting sales and load building for the year 1939. How much lighting and appliance volume you need to get a dollar of E.A.R. for your company, how much you can afford to spend to get a dollar of E.A.R., how your sales volume affects your annual average usage per customer and the yield from new kilowatt-hours—this is offered to you, as a guide for your 1940 operations in the "10th Appliance Sales Survey" in this issue.

the outlay per dollar of E.A.R. to 56 cents for the ten-year period, still a figure satisfyingly low as the price paid for continuing revenue.

All kinds of lighting, including that of the company's properties, but exclusive of street lighting, are handled by the department. On layout work for customers the department averaged 4.77 men per year in the period, while the home-lighting force rose from nothing to 7.3 men-years and then dropped back to two. The staff includes, as part of its overhead, a secretary, a draftsman and two mechanics who take care of demonstrations.

While the department has taken an active part in all national lighting programs, the policy has been one of continuous, sustained effort rather than that of periodical campaigns. The residential lighting activity was expanded somewhat in 1931 and still further in 1935, 1936 and 1937, when a crew of young women were used to promote it. Adequate wiring promotion has been one of the duties of the department. Another important function has been the maintenance of an architects' service bureau, consuming time equivalent to more than that of one man. Except in the case of the home-lighting advisers, there has been no turnover in the engineering personnel since the organization of the department.

An important factor in creating light consciousness among the public was the design and construction of a portable exhibit giving the essential features in connection with light and seeing in thirteen display cases occupying 32 ft. of wall space. This exhibit was turned over to the Maryland Academy of Sciences as part of its industrial exhibit and has been operated by it since November, 1936. The cost of the exhibit was approximately $1,500 and it has thus far been exhibited to approximately 300,000 people.

A second successful display is that designed to promote adequate wiring, in which we visualize the difference between adequacy and inadequacy in a portable demonstration cabinet. This was constructed last March and since then has been exhibited in all of the junior and senior high schools in the city, fifteen in number It is estimated that 20,000 people have seen it. For a number of years the company has operated a certification plan for adequate wiring in residences and now has a Red Seal and a Blue Seal standard, the latter being based on complete adequacy instead of the minimum. For the past five years lectures to schools and other groups have been considered one of the most effective promotional methods; 145 talks have been given to a total audience of 31,371.

Major Appliances Inspected by 3,000

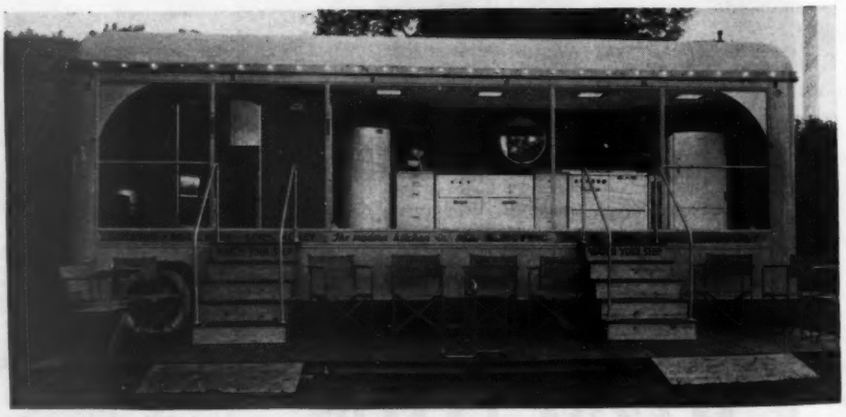
By W. E. SCHUBERT

Vice-President & General Manager
Wisconsin Michigan Power Company, Appleton

A trailer fitted out with major domestic appliances has been found useful by the company to tour county fairs and the merchandise on display has been inspected by more than 3,000 people at the various locations. It is rather difficult to give an exact cost figure for trailer construction since most of the work was done in the company's own shops and salvage material was used quite extensively.

The chassis was taken from one of our abandoned buses—a General Motors Yellow Coach Model *U*, having a 15-ft. 5-in. wheelbase. The body consists of welded steel framework covered with sheet metal and a wood floor. Over-all dimensions of the body are 7 ft. 10 in. by 21 ft. 0 in. and the over-all height is 12 ft.

The side panels are removable and the entire trailer may be inclosed



Wisconsin Michigan Power Company has reconstructed one of its abandoned buses to construct this traveling display of major domestic appliances
Trailer is shown open and closed. Platforms, stairways, chairs, canopy, etc., are portable and transported with the trailer. A cable connection is provided for attachment to the company's distribution line to energize the display.

STEP-UP STORY!

and Prices are Planned

8.2 cubic foot model
Same as S-6 *plus* extra storage space and ice capacity
16.3 square feet shelf area
Rust-proof, bar-type shelves
"Liftout" half shelf
Sliding Crisper with glass top
Automatic Light
Glass Cold Chest with Cover
Two Extra-fast Freezing Shelves
4 Pop-Out Ice Trays with special cube and tray release lever
Embossed Freezer Door
Double-width dessert tray
96 ice cube capacity—12 lbs.
Kelvin Control to regulate freezing speeds
Vegetable Bin for Dry Storage
Polarsphere Sealed Unit
Permalux finished exterior
Porcelain-on-steel interior

6.1 cubic foot capacity
Moist-Master Humidity System to keep foods moist and full flavored
14.4 square feet shelf area
Rust-proof, bar-type shelves
Two sliding adjustable shelves
Twin Sliding Crispers with Sliding Glass Tops
Twin Recessed Dome Lights
Built-in Cold Storage Compartment
Porcelain Storage Chest and Cover
Two Extra-fast Freezing Shelves
4 Trays with Built-in Ice Tray Lifters and Speedy-Cube Release
Double-width Dessert Tray
Newly Styled Freezer Door
72 ice cube Capacity—8 lbs.
New, Flat, Disc-type Kelvin Control with 12 Freezing Speeds
Vegetable Bin for Dry Storage
Polarsphere Sealed Unit
Permalux finished exterior
Porcelain-on-steel interior

8.2 cubic foot model
Same as R-6 *plus* extra storage space and ice capacity
16.3 square feet shelf area
Rust-proof, bar-type shelves
Two sliding adjustable shelves
Twin, glass covered sliding Crispers
Twin Recessed Dome Lights
Porcelain Cold Chest with Cover
Two Extra-fast Freezing Shelves
4 Trays with Built-in Ice Tray Lifters and Speedy-Cube Release
Double-width Dessert Tray with 2 speedy Cube Releases
Newly styled Freezer Door
108 Ice Cube Capacity—12 lbs.
De Luxe Kelvin Control
Vegetable Bin for Dry Storage
Polarsphere Sealed Unit
Permalux finished exterior
Porcelain-on-steel interior

8 cubic foot model—same as HD-6 *plus* extra storage space and ice capacity
Moist-Master Humidity System to keep foods moist and full flavored
15.9 square feet shelf area
Rust-proof, bar-type shelves
Two sliding adjustable shelves
Twin Sliding Crispers with Sliding Glass Tops
Twin Recessed Dome Lights
Built-in Cold Storage Compartment
Porcelain Storage Chest and Cover
Two Extra-fast Freezing Shelves
4 Trays with Built-in Ice Tray Lifters and Speedy-Cube Release
Double-width Dessert Tray with 2 Speedy-Cube Releases
Newly Styled Freezer Door
108 Ice Cube Capacity—12 lbs.
New, Flat, Disc-type Kelvin Control with 12 Freezing Speeds
Vegetable Bin for Dry Storage
Polarsphere Sealed Unit
Permalux finished exterior
Porcelain-on-steel interior

Prices suggested are for delivery in the Kitchen with 5 year Protection Plan. State and local taxes are extra. Prices are slightly higher west of the Rockies.

the Name! Look at the Price!

when traveling. On the opposite side the panels are divided horizontally and hinged, thus providing a catwalk and canopy for an operator at times when additional depth is required.

A canopy with sectional pipe framework is also provided for use in inclement weather. The stairs and platform are portable and designed in sections so they may be stored in the trailer for transporting. Interior and exterior circuits are attached to a single cable for ease in connecting to the company's distribution system. A battery is provided to furnish traffic and safety lights while it is being moved and it is equipped with air brakes and attachment to the tow car.

The display has been used at intervals ever since September, 1938. At that time it housed a farm display which was operated on turntables and presented the evolution of the old farm into an up-to-date farm through the advent of rural electrification. We have made a complete tour of our property with showings at all county fairs and several rural groups.

The display was then remodeled into a traveling window display in which we used window glass to inclose the open side of the trailer and made a tour of our territory prior to Christmas, to exhibit electrical gift suggestions. A record-playing attachment was installed to broadcast Christmas carols and it was shown in every small community in our territory.

• • •

Minimum Bill Is Key to Farm Load Growth

By C. D. HENRY
Manager, Sales Department,
Central Illinois Light Company, Peoria

A study of the consumption record of rural customers added to the lines of the Central Illinois Light Company during the past three years shows that for our company, at least, the new rural customers are the largest users of electric service. During 1938, for example, study of the average kilowatt-hour consumption of customers on one of the newer lines in three districts of the company's Peoria division yields the following comparison with the average consumption for *all rural customers*, old and new, in 1938:

Peoria Division	New Customers	Average of All Rural Customers
Eastern district.....	1,546	1,238
Western district.....	1,007	627
Southern district.....	1,951	1,304

The reason for this condition is summed up in an address by H. J. Gallagher, Consumers Power Company, in an address before the American Society of Agricultural Engineers, in which he is reported to have said that it is absolutely necessary for rural prospects to be given a minimum bill that correctly represents adequate use of service at the prevailing rates of the company.

Previous to 1936 the rural rules of our company provided a minimum charge of $1 per customer, with the customer depositing construction costs. Our present rural rate, however, calls for all construction costs to be borne by the company. Customers guarantee a minimum of $12.50 per mile per month, with no customer paying less than $2.50. Minimum bills vary from $2.50 to $6, with the average minimum bill in the Peoria division $3.70.

While in apportioning the $12.50 minimum the company assumes no responsibility in any group, an attempt is made intelligently to guide such division so that no injustice is done to any particular customer. The company tries to see that owners of the larger farms, which naturally should use more energy, assume a proper share of the $12.50. This friendly guidance on the part of the company has a psychological advantage not to be overlooked.

With the division made, the company works with the individual farmer to show him the advantage of adequate use of electric service. A studied attempt is made to help each individual to use the full amount of service to which his minimum charge entitles him. This positive approach has considerably more constructive merit than trying to devise means of lowering the farmer's minimum. We have found that with a reasonable minimum charge to work up to, the customer acquires a "taste" for electric service and is not so much inclined to be critical of usage above the minimum amount.

Fryers Pave Way for 48 Kw. of New Load

How the successful performance of a small installation can lead to a big installation, or a big one to a bigger one, is demonstrated in connection with electric cooking equipment by the experience of Eaton's restaurants. These restaurants, situated in north Hollywood and in Beverly Hills, Calif., cater to discriminating tastes and specialize in fine steaks and chops.

Entering wedge

Three 7-kw. fry kettles are used by Eaton at Beverly Hills and at Hollywood. At Santa Anita four such units will be part of a 48-kw. connected load.

Charles Eaton, the proprietor, states that electrical equipment was installed because it can be depended on to hold a desired temperature. In each of the two restaurants three 7-kw. fry kettles are installed. Steaks themselves are charcoal broiled, but deep frying is done electrically.

So successful has been the performance of electrical equipment at these two places that when Eaton's third unit opened near Santa Anita for this winter's racing season it housed an even bigger installation.

Being installed are four 7-kw. fry kettles, a 12.6-kw. automatic electric oven, a 1-kw. roll warmer, a 5-kw. Toastmaster and a 1.5-kw. waffle iron —a connected load of more than 48 kw.

NOTE! The ultra-efficient porus film which produces the light in every Hygrade Fluorescent lamp, was invented by Hygrade in 1933, and resulted in Hygrade patent No. 2096693.

AND NOW 6 HYGRADE MIRALUMES

ARE READY—TO MODERNIZE ANY COMMERCIAL OR INDUSTRIAL LIGHTING! COMPLETE UNITS—WIRED—READY TO INSTALL—*FLUORESCENT AT ITS FINEST!*

HERE it is—the best, most convenient, most efficient form of fluorescent light, for *all* lighting purposes:

Higher levels of illumination—several times the light per watt—and only 25% the radiant heat (for equal light)—without harsh glare or shadows—practically perfect daylight!

Opportunity for installation of these HYGRADE "MIRALUMES" is almost *unlimited*. Modern... beautiful... easy to specify because they are made complete by HYGRADE.

FIFTY-WATT MIRALUME—for commercial use; approx. length, 25"; 2 20-watt tubes.

INDUSTRIAL MIRALUME—HF-100—approx. length 57"; 2 40-watt tubes; 100-watt unit.

COMMERCIAL OR INDUSTRIAL—HF-200 MIRALUME: 200 watts; 4 40-watt tubes; approx. length, 50"

SHOWN HERE are four of six MIRALUMES *ready now*—as this goes to press. They are designed, engineered, built and guaranteed by HYGRADE. Wired—ready to install—no costly rewiring required.

Every MIRALUME is corrected for power factor—and stroboscopic effect (flicker). Starters are easily accessible.

Get full information from your local Hygrade jobber—or use coupon *below. Thousands are being installed each week.*

THE TRIANGLE OF LIGHT EFFICIENCY

LOW COST — FULL LIFE — MORE LIGHT

Hygrade

FLUORESCENT AT ITS FINEST—

Hygrade

Hygrade Sylvania Corp., Est. 1901. Makers of Hygrade Incandescent Lamps and Sylvania Radio Tubes

CLIP AND MAIL TODAY

HYGRADE SYLVANIA CORPORATION
SALEM, MASS.

I am interested in Hygrade Fluorescent Miralume Units... prices, discounts, full information.

COMPANY_____

INDIVIDUAL_____

ADDRESS_____

CITY AND STATE_____ EW-3

Copr. 1940 Hygrade Sylvania Corp.

NEW EQUIPMENT

Thermocouple

Inclosed in a vacuum, the thermocouple consists of a very thin filament of two different metals, blackened on one side. Radiant energy acting upon the thermocouple produces an electromotive force which is transmitted to a millivoltmeter or potentiometer which can be calibrated in degrees. The device may be mounted either

Radiation-type vacuum thermocouple for use wherever exceptionally high sensitivity and very rapid response are needed. **General Electric Co.**, Schenectady, N. Y.

temporarily or permanently upon a furnace, the only accessory needed being a closed-end tube in the furnace, to prevent fogging of the lens and to form a target upon which to sight the thermocouple. Temperatures higher than 300 to 1,500 deg. C. can be handled by the addition of protective screens or filters between the thermocouple and heat source. Possible applications include temperature measurement and control in brazing heat-treating furnaces, glass heat-treating, infra-red drying and solar radiation.

•

Fire-Fighting Unit

Stationary portable fire-fighting unit with a 50-lb. cylinder of carbon dioxide. **C-O-Two Fire Equipment Co.**, 10 Empire St., Newark, N. J.

Besides the cylinder of carbon dioxide there is a high-pressure, flexible rubber hose and a large discharge horn fitted with a quick-opening valve for control of discharge of gas. The unit may be used for protection within the hose range of fixed hazards or may be moved to any remote location where fire may break out. The company claims the discharge is non-damaging to machinery, products or finishes.

•

Power Rectifier

A new line of "Porto-Rect" a.c. to d.c. portable commercial power rectifiers for industrial use, in sizes from 12 to 200 amp. output at any standard voltage. **Cassels Engineering & Machine Co.**, Wauwatosa, Wis.

Company claims that these units have high efficiency and low losses. They require no special wiring and will furnish d.c. power from an a.c. outlet. Adjustable-speed controls for d.c. motors and the operation of magnetic devices is their greatest field.

•

Lead Sheath

This new sheath is produced by a method which includes chemical "stabilization" which, it is claimed, reduces oxidation of the lead during processing. The company states that this new process

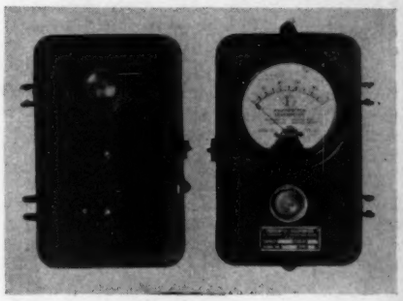
"Stabilized" lead sheath for paper cables. **Okonite-Callendar Cable Co.**, Passaic, N. J.

removes the primary causes of splits and leaks in lead sheaths and thus prevents moisture from entering and causing service failures in paper cables.

BUYING ELECTRICAL EQUIPMENT?—"Electrical World" *Electrical Buyers Reference* is a convenient place to look first for names, addresses and products of manufacturers.

Smoke Alarm

Light source and photoelectric control are mounted on opposite sides of the flue or breaching and are aligned through simple entrance tubes or windows so that



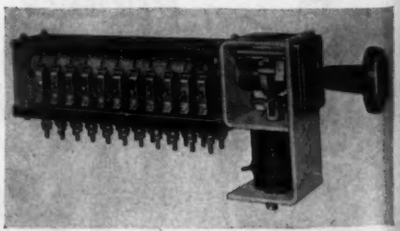
Electric eyes smoke alarm with densometer, a control of combustion conditions for power plants; photoelectric control (left) and densometer-signal combination (right), light source not shown. **Photoswitch, Inc.**, Cambridge, Mass.

the beam projected from the light source strikes the eye of the control. The densometer may be placed at any convenient location in the boiler room—usually near the other furnace controls—and is wired to the photoelectric control. The equipment is readily set so that a large red signal light indicates when the smoke density exceeds a predetermined value consistent with efficient combustion.

•

Auxiliary Switch

The new switch, essentially a spring operated with a shunt trip arrangement, is provided with any arrangement of make-and-break contacts up to 10; how-



Electrically operated auxiliary switch designed for making and breaking several circuits simultaneously, such as on a differential bus protection system where several circuit breakers are tripped at once. **Westinghouse Electric & Mfg. Co.**, East Pittsburgh, Pa.

'N SPITE OF THE MAN WHO SAID—

"THERE'S NO SUCH ANIMAL."

BUT THERE STOOD THE GIRAFFE, AS PLAINLY VISIBLE AS HUBBARD FULL ROUND, TAPERED GUY PROTECTORS APPEAR TO PASSERS-BY. EVER PRESENT—EVER WATCHFUL—GUARDIANS OF THE HIGHWAYS AND BYWAYS.

HUBBARD AND COMPANY

PITTSBURGH — OAKLAND — CALIFORNIA — CHICAGO

'HANG THE LOAD ON HUBBARD HARDWARE"

Sherman LUGS

Meet Every Requirement of the Industry

For Dependable Quality at Moderate Price

Solderless Lugs

SAFE—EASY TO USE

For many years Sherman has led in the production of fine quality Lugs at moderate prices. Today Sherman Lugs are favorably known throughout the industry.

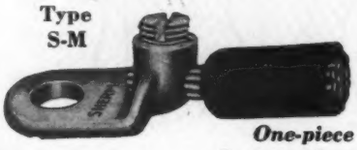
The Sherman line is very complete, including both Soldering and Solderless types in a wide range of sizes and styles. All are made from the purest materials, and to the most exacting specifications.

We will be glad to send you bulletins and specifications on this line, together with samples for your own personal examination. Let us quote you on your stock requirements.

Type S-O
Rigid and Practical

Type S-O. A heavy lug. Pure copper. Rigid and sturdy with extra contact area. Sizes from 35 to 400 Amps.

Type S-M



One-piece Low in Cost

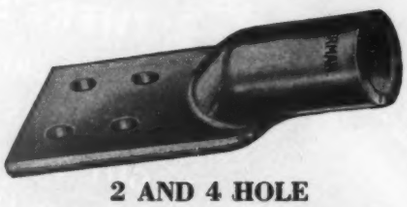
Type S-M. Low cost one-piece design. Compact and extra strong. May be soldered if desired. Made of pure copper. Sizes from 50 to 400 Amps.

Soldering Lugs

Pure Copper—Precision Made—All Styles and Sizes

ROUND END

These round end, seamless drawn lugs are recommended in preference to square end types, wherever small sizes are required. Made under the Sherman patent. Cannot leak solder at closed end. Side formed, center formed, and angle types.



2 AND 4 HOLE

Standard and Heavy Duty Lugs with the strength, weight, and construction to do the hard jobs—handle the big loads. Precision made, free from defects, with contact surfaces that are truly flat. Interchangeable with corresponding cast lugs.

We Make Prompt Delivery from Large Stocks

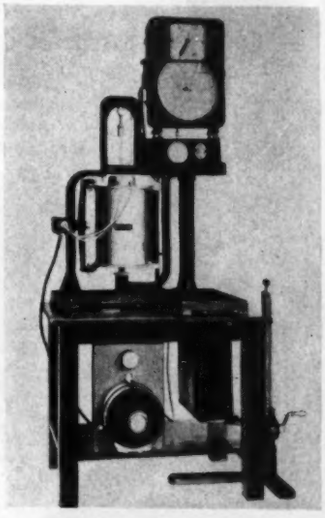
H. B. SHERMAN MFG. CO.

ever, by means of geared switches and parallel or series arrangement of the switch coils any desired number or combination of circuits can be handled. Two operating arrangements are provided as standard. One type can be tripped from the front of the panel by rotating the handle, as well as by energizing the shunt trip coil. The other type can be tripped only by operating mechanism behind the panel. Position of handle provides visual indication of the last operation of switch.

•

Dilatometer

A direct reading dilatometer, it both indicates and makes an ink record of time-dilation and temperature dilation



"Rockwell-Bristol" dilatometer, Model RB, uses a 12-in. round chart. **Bristol Co.**, Waterbury, Conn.

changes simultaneously, during heating and cooling cycles of ferrous and nonferrous metals, ceramics and materials of rigid form. Temperatures are recorded on the chart and the time element is recorded by a separate pen through a Telechron clock.

•

Lighting Unit

Fluorescent industrial lighting unit with new utility "Flu-O-Flector"; available in two sizes, for two or four 48-in. lamps. **Edwin F. Guth Co.**, 2615 Washington Blvd., St. Louis, Mo.

The four-light size provides in excess of 110 ft.-candles of light 4 ft. away from the unit. Latest accessory equipment is included with high power factor ballasts, removable starter switches and non-radio interference starting compensator.

•

Time Delay Relay

Type TD time-delay relay designed for use on alternating-current circuits to supply an adjustable or fixed time delay between the closing of one circuit and the subsequent closing or opening of a second circuit. **R. W. Cramer Co., Inc.**, Centerbrook, Conn.

Relay consists of a switch unit with contact-actuating mechanism driven in one direction by a self-starting synchronous motor with inclosed magnetically operated gear clutch and reset by means of a coil spring which is dampened. Applications

consist of (a) delay the closing of the plate circuit in radio transmitter, (b) to control the various steps of acceleration in motor controls, (c) to act as a time limit relay in elevator controls and other automatic operations where timing is required.

•

Demand Controller

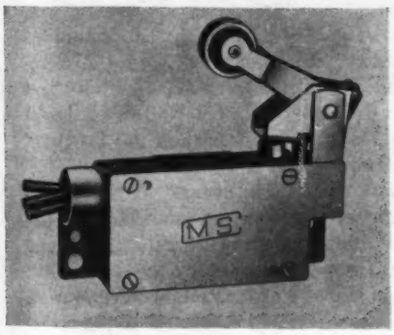
A new demand controller adaptable for peak load control to any energy consuming system such as electric, steam, gas, etc. **Moore Engineering Corp.**, Newark, N. J.

This instrument is electric eye operated from the stylus or pen arm of the demand meter which records the demand. It furnishes one energized and one de-energized circuit under control. Is equipped with automatic peak selector mechanism which prevents control action except on peak demand periods, and with synchronous timing motor supplied to conform to the utility demand period.

•

Limit Switch

Type LK now has a roller acuator that is adjustable through an arc of 225 deg. The switching element in the LK-2 is a single-pole switch with normally open, normally closed, double-throw contact arrangement. The company claims that it is resistant to oil and water and has a life of over a million operations.



Type LK-2 precision limit switch for autuation by rotating or sliding cams; movement differential at the roller of 0.002 in., a pretravel of 1 deg., an overtravel of 20 deg. and operating pressure of less than 1.8 lb. **Micro Switch Corp.**, Freeport, Ill.

•

Pilot Lamp Receptacle

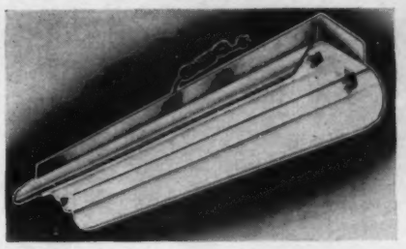
Pilot lamp receptacle for use on switchboard as an indicating device. **Electrical Specialties, Inc.**, Canandaigua, N. Y.

The new feature on this device is the use of a new material in the color caps, allowing the bulb to be burned at lower voltage than rated, states the company. The receptacle is assembled on a thick panel from one to two inches thick, with the resistor in the proper position. For panels up to one inch the resistor is reversed.

•

Fluorescent Fixture

The "Two-Forty" is recommended for lighting production areas with conventional 10-ft. spacing and mounting heights, giving approximately 20 ft.-candles per watt per square foot. It incorporates the Tulamp ballasts to correct power factor and flicker and its removable starting switches are located in sockets. Lamps and ballast consume approximately 100 watts.



"Two-Forty" fluorescent industrial lighting fixture for two 40-watt lamps. **Day-Brite Lighting, Inc.**, St. Louis, Mo.

•

TECHNICAL LITERATURE

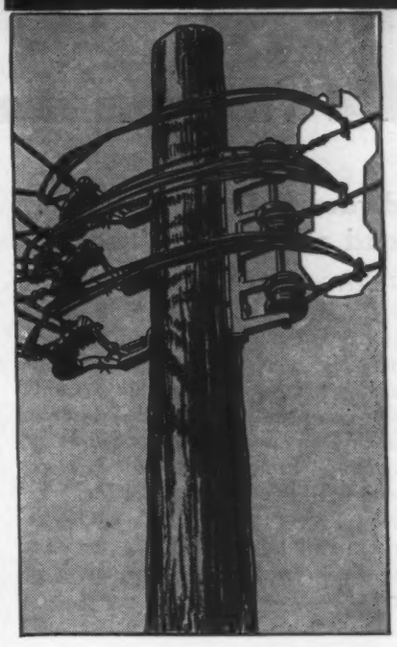
A.S.T.M. STANDARDS: — Thirty widely used specifications and test methods for rubber products are provided in this 210-page booklet. Fourteen of the standards pertain to general methods involving chemical analysis, sample preparation, tension testing, accelerated aging, air pressure heat test, abrasion resistance, adhesion, and a test for changes in properties of rubber and rubberlike materials in liquids. Also covered are tests for flexing hardness, indentation and the resistance to light checking and cracking; for rubber hose and belting; for rubber gloves, matting and tape; for insulated wire and cable, including rubber sheath compounds; for rubber cements, sponge and hard rubber products. Copies may be obtained from American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., at $1.75 per copy.

ALLOY TUBES—Contains information and technical data on B & W seamless alloy tubes and pipe for high-pressure and high-temperature services. Curves and tabulation give analysis, applications, minimum physical properties, creep strength, short time tensile strength, oxidation resistance, corrosion resistance, temper embrittlement, working qualities and approximate relative cost for fifteen different materials. Technical bulletin No. 12-A, the Babcock & Wilcox Tube Company, 19 Rector Street, New York, N. Y.

FUEL OILS—Commercial Standard for Fuel Oils (Fifth Edition) CS12-40, a revision of CS12-38. The specifications cover five grades of fuel oil for various types of fuel oil burning equipment for commercial and industrial uses. Table gives detailed requirements for fuel oils. Also given are general requirements, detailed requirements, significance of test prescribed, and certification. Copies may be obtained from National Bureau of Standards, Washington, D. C.

BELT DESIGN—"V-Belt Drive Design," explaining that the problem is simply to select sheaves and a standard belt which will transmit power from a selected motor to a driven unit at required speed, the catalog section lists the following information to be known before a drive is selected: type of machine and work to be done; r.p.m. of driving shaft; r.p.m. of driven shaft; nameplate horsepower of motor or other prime mover and space limitations. Catalog 2180 may be obtained from public relations department., B. F. Goodrich Co., Akron, Ohio.

modernize
YOUR
DISTRIBUTION
PRACTICE —



RELIABLE
MULTI-TAP
CONNECTORS

Provide neater more economical connection of service drop pigtails to secondary in crowed alley distribution.

One size accommodates No. 2 line wire and six No. 6 taps in a close fitting slot that assures dependable connections.

Reliable
ELECTRIC COMPANY
OVER 25 YEARS SERVICE TO THE UTILITIES

NEWS ABOUT PEOPLE

Edward S. Perot Elected Head of Crocker-Wheeler

Directors of the Crocker-Wheeler Electric Manufacturing Co. have elected Edward S. Perot president of the company. Mr. Perot was employed nine years by the National Conduit & Cable Co., serving two years as vice-president. For three years he was president of Dictograph Products Co. and six years president of Southern Dairies, Inc.

Mr. Perot joined Crocker-Wheeler early in 1939 as executive vice-president and was elected to the directorate in June.

•

▶ LLOYD T. MCAFEE, chief construction engineer of the Public Works Commission, San Francisco, has been assigned the duties of the late Paul J. Ost, head of the commission's electric power bureau.

▶ HOWARD B. CHURCHILL has been elected an assistant controller of Niagara Hudson Power Co. He was formerly assistant controller of New York Power & Light Corp., an operating company of the Niagara Hudson system.

▶ TOM C. POLK, prominently identified with the utility industry in Indiana, has been appointed director of safety of the Illinois Iowa Power Co., Decatur, Ill. For a number of years Mr. Polk served as secretary of the Indiana Electrical Association and of the Great Lakes division of the old National Electric Light Association.

▶ FRED H. PHILLIPS has been appointed resident sales manager for the Arkansas Power & Light Co., Pine Bluff, Ark. He succeeds MAX SUDDUTH, who has assumed the duties of assistant general sales manager.

▶ F. A. PARNELL, who has long been identified with General Electric's construction materials division at Bridgeport, Conn., has relinquished his duties as sales manager of conduit products to become associated with the General Electric home bureau and will henceforth handle sales development and distributor contact assignments.

•

Illinois Utility Names Sedwick General Manager

Several changes in the organization of the Public Service Co. of Northern Illinois were made public recently.

H. P. Sedwick has been appointed

general manager of the company and will assume the duties heretofore delegated to the general division manager.

C. G. Bennett has been appointed manager of rates and industrial sales and J. R. Pershall manager of merchandise sales and advertising. Mr. Pershall and Mr. Bennett will report to the general manager of the company.

Mr. Sedwick started with the company in 1913 as an assistant inspector at Evanston. Four years later he was transferred to Waukegan as an inspector. In 1919 he became chief clerk at Waukegan. Mr. Sedwick was appointed superintendent of District E (Crystal Lake) in 1921, where he remained until 1922, when he was transferred to the general office as secretary of the budget and expense committee. Then he was appointed assistant to vice-president in-charge-of-operations and in 1933 he was appointed general district manager. This title was changed to general division manager later in the year.

•

W. H. Lines of Portland Resigns Vice-Presidency

W. H. Lines, vice-president and treasurer of Portland General Electric Co., Portland, Ore., has resigned. Mr. Lines first became associated with the Portland properties in 1912, when he left the Rochester (N. Y.) Railway & Light Co. to join what was then the Portland Railway, Light & Power Co.

He spent four years as industrial engineer and one as secretary to the president, resigning in 1917 to become plant superintendent of the Northwest Steel Co. of Portland. After terminating this connection he started a manufacturing business of his own, but in 1923 returned to the Portland utility.

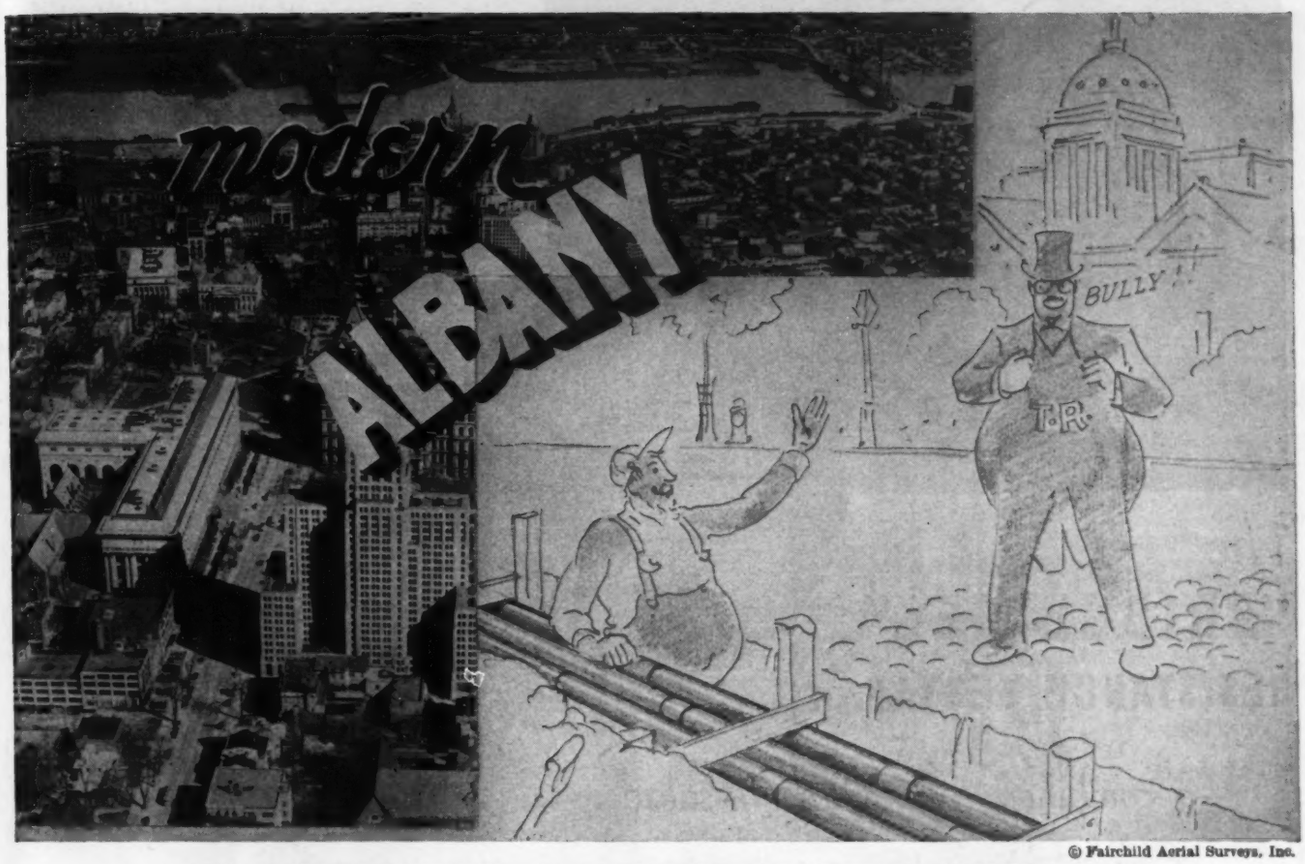
•

▶ FRANKLIN S. KOONS, vice-president of the Queens Borough Gas & Electric Co., has been elected a member of the board of directors to succeed the late George W. Olmstead.

▶ G. T. SHOEMAKER, who resigned in 1938 as vice-president of the Kansas City Power & Light Co., will return to the company in the near future as vice-president in charge of power production. Mr. Shoemaker resigned to take an emergency appointment as president of the United Light & Power Service Co., a subsidiary of the United Light & Power Co.

▶ G. M. MILLER, formerly superintendent of electrical distribution and construction, Louisville Gas & Electric Co., Louisville, Ky., has been appointed electrical engineer of the company. J. F.

ORANGEBURG HAS *long* BEEN PART OF



© Fairchild Aerial Surveys, Inc.

150 miles up the Hudson River,—125 miles above Orangeburg, New York, home of ORANGEBURG Fibre Conduit,—Albany, New York is accessible to large ocean liners and is rapidly growing in importance as a world port.

CABLE PROTECTION

Orangeburg is chemically inert. The cables are protected from alkaline contact or acid corrosion when installed underground. It is impermeable to ground-water and watertight at joints.

One of the many **ORANGEBURG "Points That Count"**

The Orangeburg trademark is a guarantee of the best of Fibre Conduits, a time-tested, enduring "service" of cable protection wherever electrical raceway facilities are to be installed underground.

● Albany was one of the pioneers of electrical distribution, underground. Started in 1896 its carefully engineered underground system has kept pace with the City's expansion in all directions.

ORANGEBURG, serving Albany since the middle nineties, has helped meet difficult underground conditions of moisture and soil.

Specifying ORANGEBURG is proven cable protection insurance against alkaline-contact and all cable sheath corrosion dangers. It is an assurance of the ultimate, as well as immediate, economy of an important capital investment when you "go underground."

For installation underground WITH CONCRETE ENCASEMENT: Orangeburg STANDARD FIBRE CONDUIT is recommended for duct banks (4 ducts and over), main distribution, high tension and "downtown" locations.

For installation WITHOUT CONCRETE ENCASEMENT, the Orangeburg dual economy NOCRETE conduit is recommended for service entrances, extensions, parkways and street lighting, suburban distribution, laterals, signal systems, etc.

Sales Agent—Distributors

GENERAL ELECTRIC SUPPLY CORP. **GRAYBAR ELECTRIC COMPANY INC.**

MADE AT ORANGEBURG, NEW YORK BY THE FIBRE CONDUIT COMPANY 292 MADISON AVE. NEW YORK CITY

ORANGEBURG *Standard* for installation *with* concrete encasement
NOCRETE for installation *without* concrete encasement

The
"BRIDGE-MEG"
RESISTANCE TESTER

—a combined "MEGGER"* Insulation Tester and Wheatstone Bridge

For industrial and other engineers who have electrical equipment to install and maintain—here is a *complete* resistance-measuring outfit all built into one portable set that weighs only about 13 lbs. With it you can test the insulation of all types of electrical equipment and detect and forestall trouble. You can measure coils, contacts and relays. You can locate many troublesome faults. The set is portable and rugged—suitable for every day hard use.

Let us tell you more about this unique instrument that has the remarkably wide range of .01 ohm to 200 megohms. Self-contained constant-pressure generator rated 250, 500 or 1000 volts d.c. Write for descriptive Bulletin 1615-W.

* Trade Mark Registered U. S. Pat. Off.

James G. Biddle Co.
1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

MILLER, formerly assistant superintendent of electric distribution, has been made superintendent, and V. L. McKINLEY, formerly meter engineer, has been made assistant superintendent. M. S. WINSTANDLEY has been appointed electrical construction engineer and C. M. EWING assistant superintendent of electrical production.

•

Elliott Company Appoints Peterson to Direct Sales

V. H. Peterson, who for the past two years has been assistant to the president in co-ordinating sales activities, has been named general sales manager of the Elliott Company, Jeannette, Pa. Mr. Peterson has been with the Elliott Com-

pany since 1925. He served as sales engineer in the Pittsburgh office and district manager of the Rochester and Washington, D. C., offices before returning to Jeannette in 1938.

•

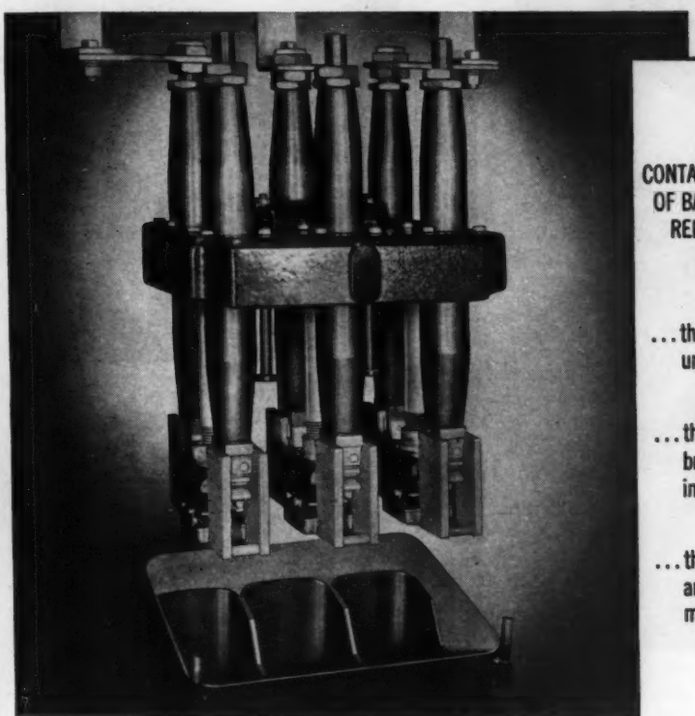
▶ TOMLINSON FORT has been appointed assistant manager of central station sales for the Westinghouse Electric & Manufacturing Co. and will be located at East Pittsburgh. Mr. Fort has been connected with Westinghouse since 1923.

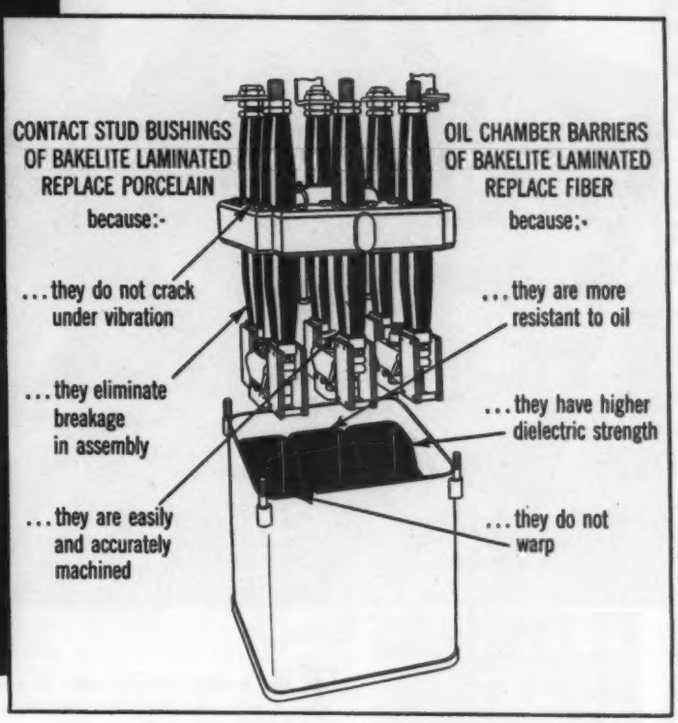
▶ DAVID C. SPOONER, JR., associated with General Electric appliance activities for more than 20 years, has been appointed to manage a newly formed "pioneer products" section of the G.E. appliance division. The section will handle new products not logically falling within the scope of existing sections and such other products as may be assigned to it. H. A. COOK, who has been assistant commercial engineer for G. E. Wiring materials, has been named manager of the new miscellaneous construction material sales section. Chief function of the section, also just formed, will be the introduction of new lines

OIL SWITCH INSULATION

Withstands Shocks at 75,000 Volts

WHEN MADE OF BAKELITE LAMINATED




CONTACT STUD BUSHINGS OF BAKELITE LAMINATED REPLACE PORCELAIN because:-
...they do not crack under vibration
...they eliminate breakage in assembly
...they are easily and accurately machined
OIL CHAMBER BARRIERS OF BAKELITE LAMINATED REPLACE FIBER because:-
...they are more resistant to oil
...they have higher dielectric strength
...they do not warp

INSULATION requirements for switches used on power distributing equipment demand not only unusual dielectric strength, in order to assure uninterrupted service, but resistance to mechanical shocks as well. These are some of the reasons why Bakelite Laminated (Micarta) was selected to perform two important functions in the 75,000-volt oil switch illustrated above.

Replacing porcelain for contact stud bushings, this sturdy material obviates breakage from vibration when switches are thrown, thereby eliminating costly and time-consuming replacements. Moreover, the 15-inch long bushings are easily and more accurately formed now that they are machined from Bakelite Laminated tubing.

Oil chamber barriers, also, are made from Bakelite Laminated—instead of fiber. Tough, permanent in shape and resistant to oil-deterioration, they afford safe and enduring insulation between breaker contacts of switch poles.

There are many types of dielectric Bakelite Plastics at your disposal. Contributing long and efficient life to electrical equipment, they offer distinct economies in production, too. Write for illustrated booklets contained in Portfolio 3, describing these materials in detail.

BAKELITE CORPORATION, 247 PARK AVE., NEW YORK

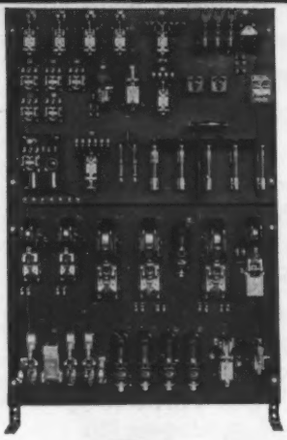
Unit of Union Carbide UCC *and Carbon Corporation*

BAKELITE

PLASTICS HEADQUARTERS

What has the CONTROL to do with

EASY STRIPPING!



THIS simple control, used on 4-spindle wire-drawing machines which are equipped with an adjustable speed motor for each spindle, is giving excellent results in drawing high carbon wire.

Although the weight of the wire added to the last spindle increases the flywheel effect of the last motor-drive, EC&M has engineered a system of control which compensates for this condition automatically. The EC&M Full Magnetic Controller is designed to distribute the dynamic braking torque in proportion to the inertia of each spindle-drive so that all spindles stop *uniformly* . . . under any condition of load.

And when ready to strip a coil, EC&M allows the last or gathering spindle to be backed up easily by hand, permitting slack in the wire when a finished coil is to be removed.

This unique method of control for wire-drawing machines gives superior operating results. Consult our nearby sales office for complete data.

Note simplicity of design of this EC&M Wire-drawing Machine Controller. It is built with LINE-ARC Contactors and NEO-TIME Acceleration.

THE ELECTRIC CONTROLLER & MFG. CO. E C & M CLEVELAND, OHIO

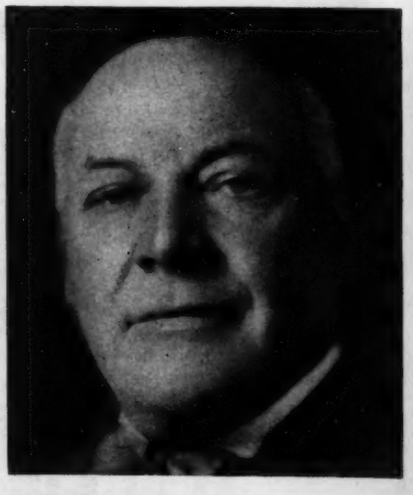
HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS.

and co-operation with other sections in the adding of new devices and products.

•

Falk Corporation Elects New Executive Officers

The Falk Corp., Milwaukee, Wis., has announced that Herman W. Falk, founder of the company and president since its inception, has become chairman of the board and is succeeded as president by Harold S. Falk.



H. W. Falk

H. S. Falk

Harold Sands Falk, until now vice-president and works manager, entered the employ of the Falk Corporation in 1906, the year in which he was graduated from the University of Wisconsin, as assistant to the superintendent. During the period from 1906 to 1920 he was employed in various departments of the plant. In 1920 he was appointed vice-president and works manager.

The name of Herman W. Falk, founder of the company, is now practically synonymous with the manufacture of precision herringbone and single

YOUR "LOOKING UP" PLACE FOR 1940

SPEEDY
DELIVERIES
No matter how complex your particular requirements may be, you can depend upon Pennsylvania Transformer Company to provide quick deliveries.
TOMORROW'S TREND TODAY · TRANSFORMERS
Pennsylvania TRANSFORMER COMPANY
1701 ISLAND AVENUE, N. S., PITTSBURGH, PA.

helical gears, which he commenced in 1910 and on which he did considerable pioneering work in the United States. He is the owner of many important patents on his own inventions made during the years when the company was growing from its very small inception to one of the biggest plants of its kind in the world. Despite the task of building this establishment he has engaged in broad activities outside, being a director in many important companies.

OBITUARY

▶ SAMUEL E. FOLK, for many years superintendent of the Bryan, Ohio, municipal power plant, died February 20, after a long illness. Mr. Folk was 76 years of age.

▶ GEORGE H. CHARRON, 69, retired electrical engineer associated with the General Electric factory at Lynn, Mass., for more than 25 years and for some time identified with the research laboratory there, died at his home in Swampscott, Mass., on February 24.

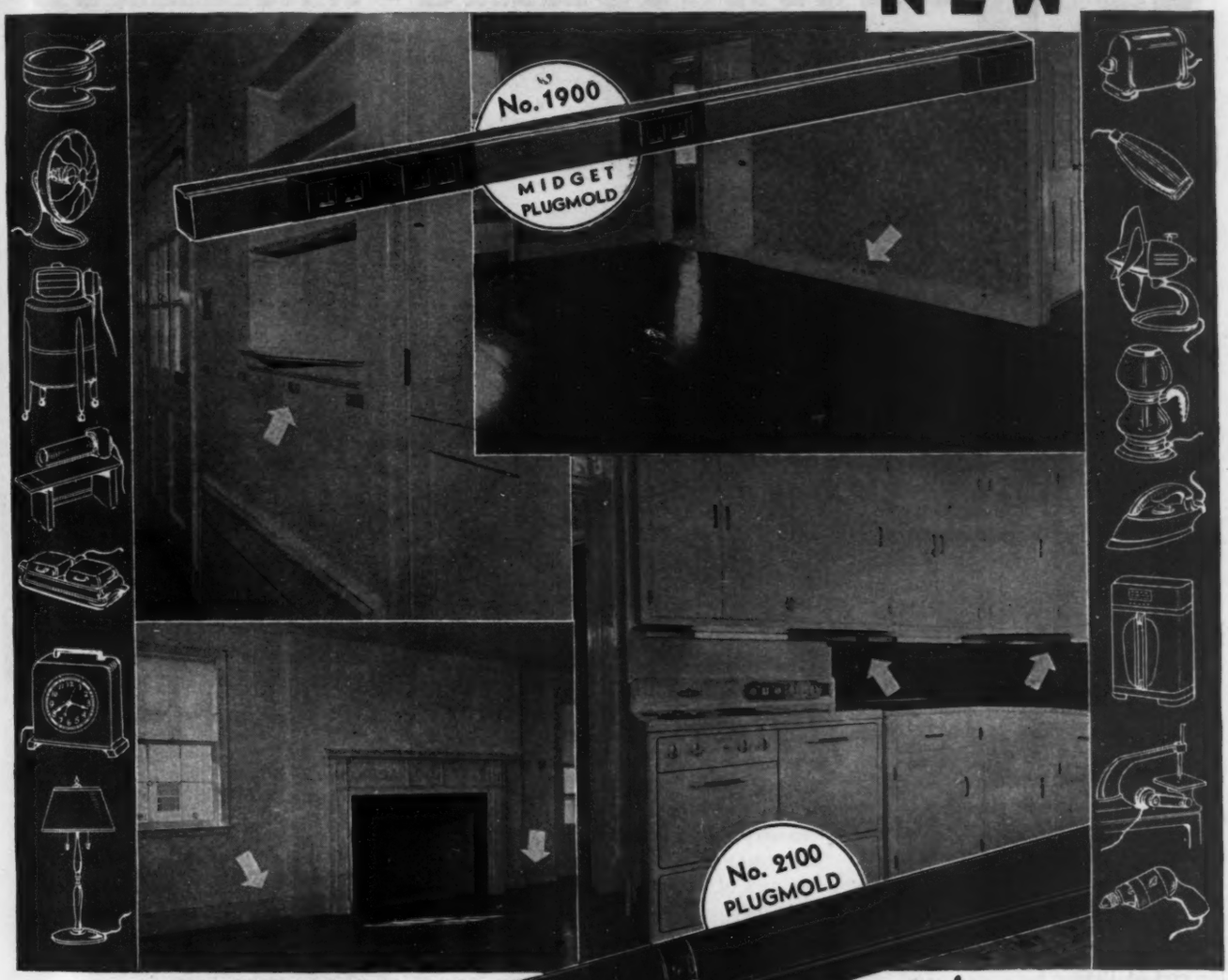
▶ GEORGE A. CAMPBELL, president of the Sierra Pacific Power Co., Reno, Nev., died in New York January 12, following an abdominal operation. Mr. Campbell had been associated with the Nevada utility since 1905. In 1906 he was made superintendent of the company's gas department and one year later became general manager of the utility. In 1930 he was named president. Mr. Campbell was born in Sacramento in 1873.

▶ ALBERT H. ELLIOT, attorney and secretary for the Pacific Division of the National Electrical Wholesalers' Association, died in Oakland, January 18, after a short illness. Mr. Elliot was born in San Francisco in 1868, was graduated from the University of California, and was admitted to the California bar in 1893. He practiced law in San Francisco continuously since that time. His connection with the electrical industry started shortly after 1900, when he served as secretary for a local group of wholesalers' credit managers.

▶ AUGUSTINE L. DONNELLY, general supervisor of testing section, Philadelphia Electric Co., died recently. Following graduation from the University of Pennsylvania, Mr. Donnelly worked for a short time for the Huntingdon Valley Electric Co., Wynnecote, Pa., and then became associated with the General Electric Co. In 1911 he joined the Philadelphia Electric Co. as a testing engineer in the laboratory. Later he became assistant supervisor, then supervisor of the testing laboratory, before becoming general supervisor of the testing department.

UTILITY'S WORRIES VANISH

WHEN HOMES ARE WIRED THIS NEW WAY



with "PLUGMOLD" Multi-Outlet SYSTEMS

Dozens of outlets where there used to be two or three . . . complete, approved wiring *throughout* the house . . . right up to the point of plugging in the appliance. "PLUGMOLD", The Wiremold Multi-Outlet System is extremely important to utility men.

No more service calls on "home made" extension cord failures; no more substandard extention wiring to worry about on your circuits. Electricity at the customer's fingertips *inviting constant use.*

Better put a little PUSH behind this PLUGMOLD System of adequate home wiring. One day every MODERN home will be wired this way . . . and that is going to mean better public utility customers, better served.

The Wiremold Engineering Department constantly works with and for public utilities in promoting the industry's interests. Write us. Get to know Wiremold and what we can do *for you.*

Get to know

THE WIREMOLD COMPANY, HARTFORD, CONNECTICUT

ADEQUATE WIRING SERVES AND SAVES

WIREMOLD

LIGHTING and WIRING EQUIPMENT

MANUFACTURING - MARKETS

Net Increase Shown by General Electric

Preliminary results of operations for 1939 for General Electric Co. showed sales billed of $304,680,000, as against $259,484,000 for 1938, a gain of 17 per cent. Orders received totaled $360,748,000, or 48 per cent more than in 1938.

Net income was $41,236,000 for 1939, equivalent to $1.43 a common share, against 96 cents a share in 1938. Cash dividends paid totaled $1.40, against 90 cents a share. Directors declared a dividend of 35 cents a share for the first quarter of 1940, payable April 25 to stockholders of record on March 15.

Last year the company paid taxes of $21,013,000, against $15,632,000 in 1938.

Current assets amounted to $205,734,000 and current liabilities were $40,110,000.

Current receivables from customers, after reserves, were carried at $22,021,000, against $16,801,000 a year earlier.

Inventories, after reserves, amounted to $74,645,000, against $68,518,000 at the end of 1938.

The amount at which the company's total investments were valued at the end of 1939, before deducting reserves, was $164,829,000, against $166,509,000. After reserves, the net value was $140,561,000, against $141,528,000.

Capital expenditures for plant and equipment during 1939 totaled $11,024,000, against $12,000,000 in 1938.

Earned surplus at the end of 1939 totaled $124,310,000, against $122,671,000 at the end of 1938.

On December 31, 1939, there were 209,914 stockholders, against 208,580 a year earlier.

•

Buys Site for Warehouse

Announcement has been made that the Owens-Illinois Glass Co. has purchased from the Irving Trust Co., as trustee, in a cash deal the vacant triangular block bounded by Skillman Avenue, Davis Court and Hunters Point Avenue, Long Island City. On the site, which contains about 110,000 sq.ft., Owens-Illinois Glass will erect a building of approximately three stories to be used as a storage warehouse.

•

Manufacturers Show Sales Gain of 35%

Manufacturers' sales of electrical machinery, apparatus and supplies in January, as reported by 83 firms, amounted to $38,039,000, a gain of 4.6 per cent over December and of 35.4 per cent over January a year ago, according to the Department of Commerce.

These figures compare with an all-industry total of $347,752,000 in January, gains of 0.6 per cent over December and of 22.1 per cent over January last year.

•

No Action on Common

Directors of the Johns-Manville Corp. voted the regular quarterly dividend of $1.75 on the preferred stock, but took no dividend action on the common. Payments on the common stock last year were 75 cents in September and $2 in December.

•

Generator Contract

The Bureau of Reclamation has awarded a contract to the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., for electric generator at $76,420, for installation in Minidoka hydro-electric power station, Minidoka project, Idaho. Award for hydraulic turbine and governor has been made to Baldwin-Southwark Corp., Eddystone, Pa., on bid of $69,720.

Issue Statements of 1939 Operations

Among the electrical manufacturing companies that have recently issued statements covering 1939 operations are the following:

GENERAL CABLE—Net income, $733,166, after all charges and taxes, contrasted with net loss of $893,714 in 1938; sales, $3,860,587, against $2,368,941.

BABCOCK & WILCOX—Preliminary annual statement for company and its wholly owned subsidiaries, net profit $1,168,792 after taxes and all charges, equivalent to $1.74 a share on the capital stock, contrasted with a net loss of $3,089,191 reported for 1938.

CENTURY ELECTRIC—Net profit $116,525, equivalent to 25 cents a common share. In 1938 the company reported a deficit of $172,399. Current assets at the end of the year amounted to $2,351,962; current liabilities, $711,107. E. S. Pillsbury, president, reports a decided pick-up in business during the last half of the year. "The immediate outlook for business," Mr. Pillsbury said, "is good but not as good as it was several months back. Nevertheless, there are reasons for confidence that earnings during the first half of 1940 will equal those for the year 1939."

ELECTRIC STORAGE BATTERY—Including subsidiaries, net profit, $1,820,661, equal to $2 a share on the combined 907,810 shares of common and preferred stocks, compared with a net profit of $948,831, or $1.04 a share on the combined stocks in 1938.

•

Laundry Unit Shipments Advance 8% in January

Household washers shipped in January aggregated 119,228, compared to 109,909 in the same month of 1939, an increase of 8.48 per cent, according to industry totals reported by Joseph R. Bohnen, executive secretary-treasurer of the American Washer and Ironer Manufacturers' Association.

"January, furthermore, topped December, showing an advance of 54.3 per cent past the total of 77,270 reported in the previous month," Secretary Bohnen said. "It also was the third highest January in the industry's history."

Here's the Simplest Way to Study Generator Insulation

CENTRAL STATION engineers now recognize that a single measurement of the insulation resistance of electrical generators gives no true indication of generator leakage. The value of insulation resistance can be obtained only by a series of measurements taken at increasing time intervals over a considerable period of time. From these resistance-time curves a true picture of the condition of the insulation may be obtained.

The General Radio Type 544-B Megohm Bridge with its 500-volt power supply is the ideal instrument for obtaining resistance-time curves of any generator. Its features include:

A-C OPERATION—portable (25½ pounds) no bulky dry batteries—no hand cranking of a generator

WELL REGULATED POWER SUPPLY—vacuum-tube stabilized (very essential when testing large generators with high winding capacitance)

TEST VOLTAGE AT 500 VOLTS D.C.—the standard voltage for measurements of this type

VERY WIDE RANGE—up to 100,000 megohms—will measure the best of generator insulating materials

PRICE:
Type 544-B Megohm Bridge . . . A-C Operated with 500-volt supply.

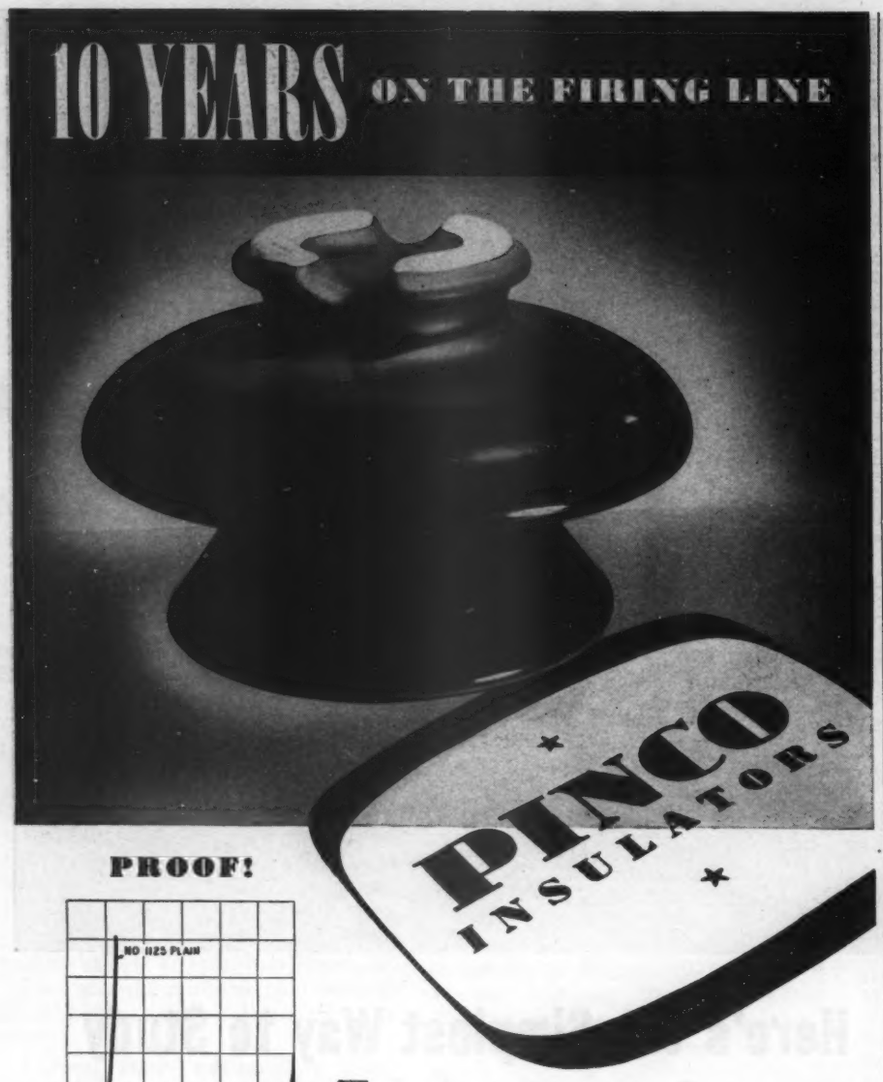
$235.00

Let us tell you more about this valuable G-R instrument which should be an essential in every generating station.

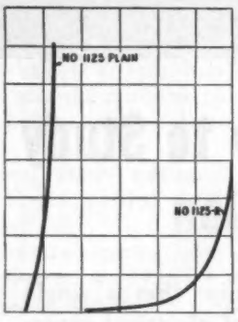
Write for Bulletin 557

GENERAL RADIO COMPANY CAMBRIDGE MASSACHUSETTS

10 YEARS ON THE FIRING LINE



PROOF!



Performance curves of Pinco plain and "NO-CORONA" Nos. 1125, 1125R 45KV One-Piece Insulators.

TEN years of line proving—through the frost of winter and the heat of summer...ten years of successful silencing of noisy lines—prove that the "PINCO" principle of "fired in" radio proofing is right. Time proved Pinco "NOCORONA" Quiet Insulators mean bettered public relations. Let us submit samples for tests. THE PORCELAIN INSULATOR CORPORATION, LIMA, NEW YORK.

Distributed through* The Joslyn Mfg. & Supply Co. *and affiliates

Budget NOW *for* OSMOPLASTIC

Pennsylvania utilities have treated approximately 50,000 poles with Osmoplastic since 1935. Names on request.

GROUNDLINE TREATMENT

—AND YOU'LL BUDGET LESS FOR FUTURE POLE REPLACEMENTS!

AT a cost of only $1 to $2 per pole (including labor) Osmoplastic Groundline Treatment extends pole's service life 7 to 10 years—a handsome dividend on your modest investment in the treatment, and a still greater dividend in protection to your investment in poles themselves. Treatment is simple as A-B-C. Effectiveness positively proved by experience of more than 50 leading utilities. Write for literature.

OSMOSE WOOD PRESERVING CO. *of America, Inc.*

GENERAL OFFICES, 1437 BAILEY AVE., BUFFALO, N. Y.

January ironer shipments were 10,373, gain of 6.81 per cent over the January, 1939, total of 9,712, and 12.49 per cent below the December shipments, which were 11,854.

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently announced the following appointments to their sales staffs:

W. N. Matthews Corp. has appointed as a new agent for its Texas territory Wayne N. Pummill, P. O. Box 382, Arlington, Tex.

Elliott Co., Jeannette, Pa., has named W. A. Elliott, for the past two years Cincinnati district manager, Chicago district manager. E. H. Haslam, who has served for twelve years as Chicago district manager, requested that he be relieved of the management responsibilities of the office, and remains in the Chicago office as a special representative. J. A. Gerlach is now manager of the Cincinnati district sales office. Two new men in the New York district office are A. R. Foote and F. S. Wardwell. H. W. VanCleve has joined the Philadelphia district office as sales engineer.

•

Allis-Chalmers to Build Unit for Wisconsin Utility

Allis-Chalmers Manufacturing Co. is constructing the 30,000-kw. hydrogen-cooled turbo-generator for installation in the Edgewater power station, on Lake Michigan near Sheboygan, of Wisconsin Power & Light Co. The contract, which includes a condenser and auxiliary equipment, is approximately $700,000.

The new unit consists of a tandem-compound steam turbine designed for 650 lb., 800 deg., and 29 inches of vacuum. It will be direct-connected to a 3,600-r.p.m., 12,500-volt, hydrogen-cooled generator of the latest design.

•

Babcock & Wilcox Orders

Unfilled orders of the Babcock & Wilcox Co. at the end of 1939 totaled $23,248,345, as against $14,790,997 a year earlier, although the rate at which orders have been received has decreased somewhat in recent months, according to A. G. Pratt, president.

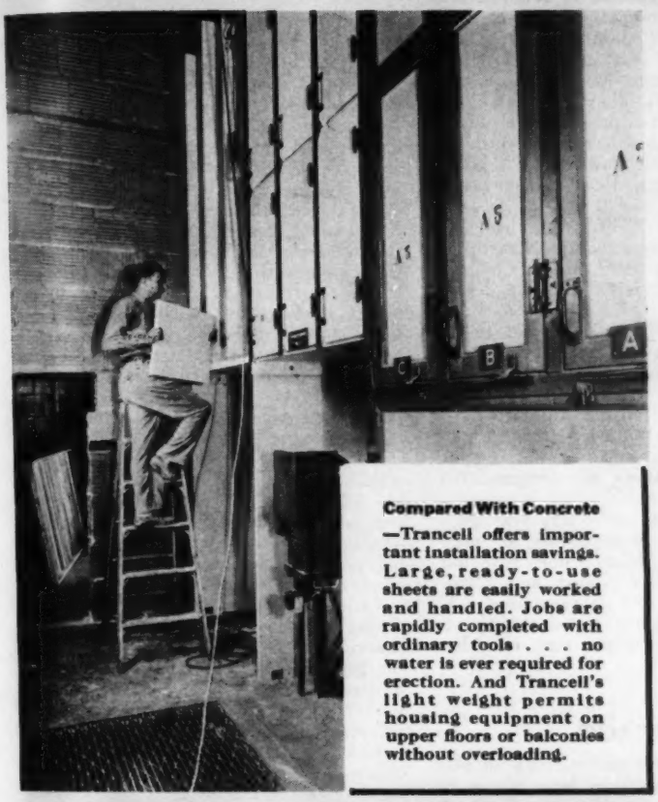
New York Metal Prices

	March 5, '40 Cents per Pound	Feb. 28, '40 Cents per Pound
Copper, electrolytic	11.50*	11.50*
Lead, A.S. & R. price	5.25	5.00
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc, Spot	6.14	6.14
Tin, Straits	47.25	48.00
Aluminum, 99 per cent	20.00	20.00

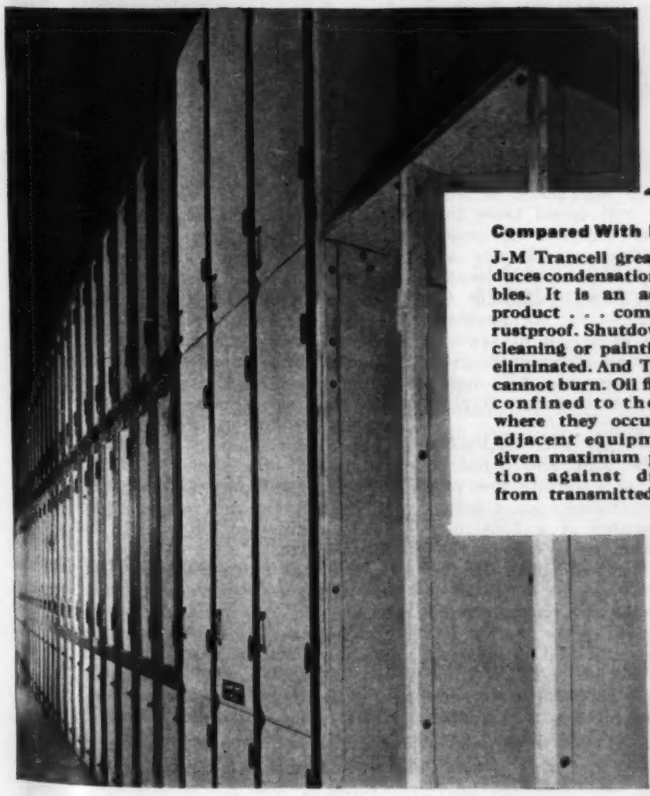
*Delivered Connecticut Valley.

Save on Construction . . . Save on Maintenance

BUILD CELL STRUCTURES with J-M TRANCELL



Compared With Concrete—Trancell offers important installation savings. Large, ready-to-use sheets are easily worked and handled. Jobs are rapidly completed with ordinary tools . . . no water is ever required for erection. And Trancell's light weight permits housing equipment on upper floors or balconies without overloading.



Compared With Metal, J-M Trancell greatly reduces condensation troubles. It is an asbestos product . . . completely rustproof. Shutdowns for cleaning or painting are eliminated. And Trancell cannot burn. Oil fires are confined to the cells where they occur, and adjacent equipment is given maximum protection against damage from transmitted heat.

Light in weight, easy to work and handle, J-M Trancell is quickly installed . . . forms fireproof, rustproof housings at low cost . . .

YOU make important savings on cell-structure installation when you build with J-M Trancell. Supplied in large, light sheets, it is easily worked with ordinary tools. Construction is entirely dry . . . finished housings are neat and attractive. Floor loading is minimized.

And because Trancell is an asbestos product, it cannot rust . . . never causes shutdowns for cleaning or painting. Being fireproof, it confines oil fires to the cells in which they start. And its low heat conductivity prevents damage to adjacent equipment.

You should have full details. Write for brochure DS-426. Johns-Manville, 22 East 40th Street, New York, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANCELL

an asbestos product for better cell structures and doors

Globar
REG. U. S. PAT. OFF.

A monthly meeting place for news and views about High Temperature Electric Heat

THE STORY SO FAR . . . Last month we were just starting to explore the broad field for high temperature electric heat (in other words, "Globar") when the Editor rang the gong on us.
Here are some further facts about the unique characteristics and unique construction of "Globar" elements.

Manufacturing Process

To begin with, Globar Brand Non-Metallic High Temperature Electric Heating Elements are made up of specially sized crystals of a specially developed grade of Carborundum Brand Silicon Carbide, to yield the desired electrical resistivity and operating characteristics, and to insure uniform quality of the final product. The elements are then fired at temperatures up to 5432°F. (3000°C.) in electric furnaces designed for the purpose. It is this high temperature which insures a wide margin of safety in the operating temperature range of the elements (1400° to 2750°F.). "Globar" elements are discreet crystals, not molded and held together with a binder, but knit together through a process of recrystallization which insures a mechanically stable element. In their final form, "Globar" elements are technically pure silicon carbide.

They are made in the form of cylindrical rods and tubes, in diameters ranging from ¼" to 3", in length from 4" to 72", and in capacities up to 60,000 watts. These elements are made from silicon carbide produced in our own plants by scientifically controlled processes, insuring a continuous and dependable source of supply for the finished product.

More next month. But don't wait. If you have any heating process that "Globar" would seem to fit into, write us and we'll help you work out the problem.

GLOBAR DIVISION
THE CARBORUNDUM COMPANY
REG. U. S. PAT. OFF.
Niagara Falls, N. Y.

[Carborundum and Globar are registered trade-marks of The Carborundum Company]

No. 2 of a Series. We will be glad to send a reprint of No. 1 if you so desire.

Field Reports on Business

Production is now running at about the rate of incoming orders. Damage resulting from heavy rains, sleet and ice has necessitated extra work and purchase of materials. Many business leaders are more hopeful and feel that the upturn will get under way late in the spring.

NEW YORK

The trend in business in recent weeks indicates that incoming orders are at about the level of production in many lines. Many plants have been clearing up backlogs and shipments have been moving steadily. Opinion is that production will be stabilized at the present level of incoming orders and will remain until late in spring, when the new wave of anticipated buying starts. Hand-to-mouth buying is in evidence.

Clark Controller Co. reports that business in the first two months was up 20 per cent over same 1939 period. Company has added a night force in some departments.

General Cable Corp. is to add to the Bayonne, N. J., plant a two-story structure to be used exclusively for high-voltage cable research.

New York City Housing Authority is to accept bids March 14 for a $1,350,000 bond issue, proceeds to be used for a new project. Several others are contemplated. Private residential construction is expected to be an important factor this year.

General Electric is organizing all salesmen of its home appliance lines to stimulate sales. Kelvinator reports new refrigerator models to sell approximately $5 under present cheapest model. Shipments are now running 100 per cent over last year.

CHICAGO

On the whole, business activity in this area continued to subside, but there were indications that the decline may be leveling off, particularly in the manufacturing industries. Production in the automobile centers picked up rather sharply during the past week and the rate for the next month or two is scheduled for steady increase.

Santa Fe Railway placed an order for four 2,000-hp. Diesel-electric engines with Electro-Motice Corp. Milwaukee Railroad announced that it will spend more than $8,000,000 this year for new equipment, including air conditioning 25 cars and purchasing 18 new Diesel-electric locomotives. Westinghouse Electric Elevator Co. was awarded a contract for six automatic passenger elevators at a cost of approximately $175,000. In an office building remodeling job 600 circuits, 344 lights, 1,212 receptacles and three motors totaling 450 hp. will be installed.

A survey reveals that over $3,300,000 was invested in new plant and industrial equipment in this area during the past month. Statler Hotel interests are negotiating for the construction of a 1,500-room hotel in Chicago at a cost of $5,000,000. Goodrich Electric Co. will spend $25,000 for a plant addition.

Retail merchants report a sharp increase in refrigerator sales since the market has become more or less stabilized. A majority of the units being sold are well above the lowest price class. Department store sales continued to advance, increasing the margin of gain over a year ago to 8 per cent. Electrical power output showed an increase of 1,077,000 kw.-hr., but the gain over last year was narrowed to 7 per cent.

PACIFIC COAST

Continued heavy rains and rapidly melting snow storage on lower slopes of the Sierras have caused flood conditions throughout the upper Central Valley of California from Redding to Sacramento inclusive. Property damage is considerable and retail merchandising especially will be disrupted until late spring. Wholesalers report a surprisingly good February throughout greater part of Pacific slope and mountain hinterland. Private building, largely of frame construction, is a considerable item and sales of cheaper dwelling fixtures and wiring devices are very good. Prices are fairly steady, the changes being due to downward revisions by steel manufacturers of metallic conductors, braid X or loomwire, and other roughing-in material.

Projected government expenditures include the Gila project in Arizona, which has $1,500,000 from reclamation service to finance construction of power lines. California payrolls in January registered 20 per cent increase over January last year; employment was up 19 per cent.

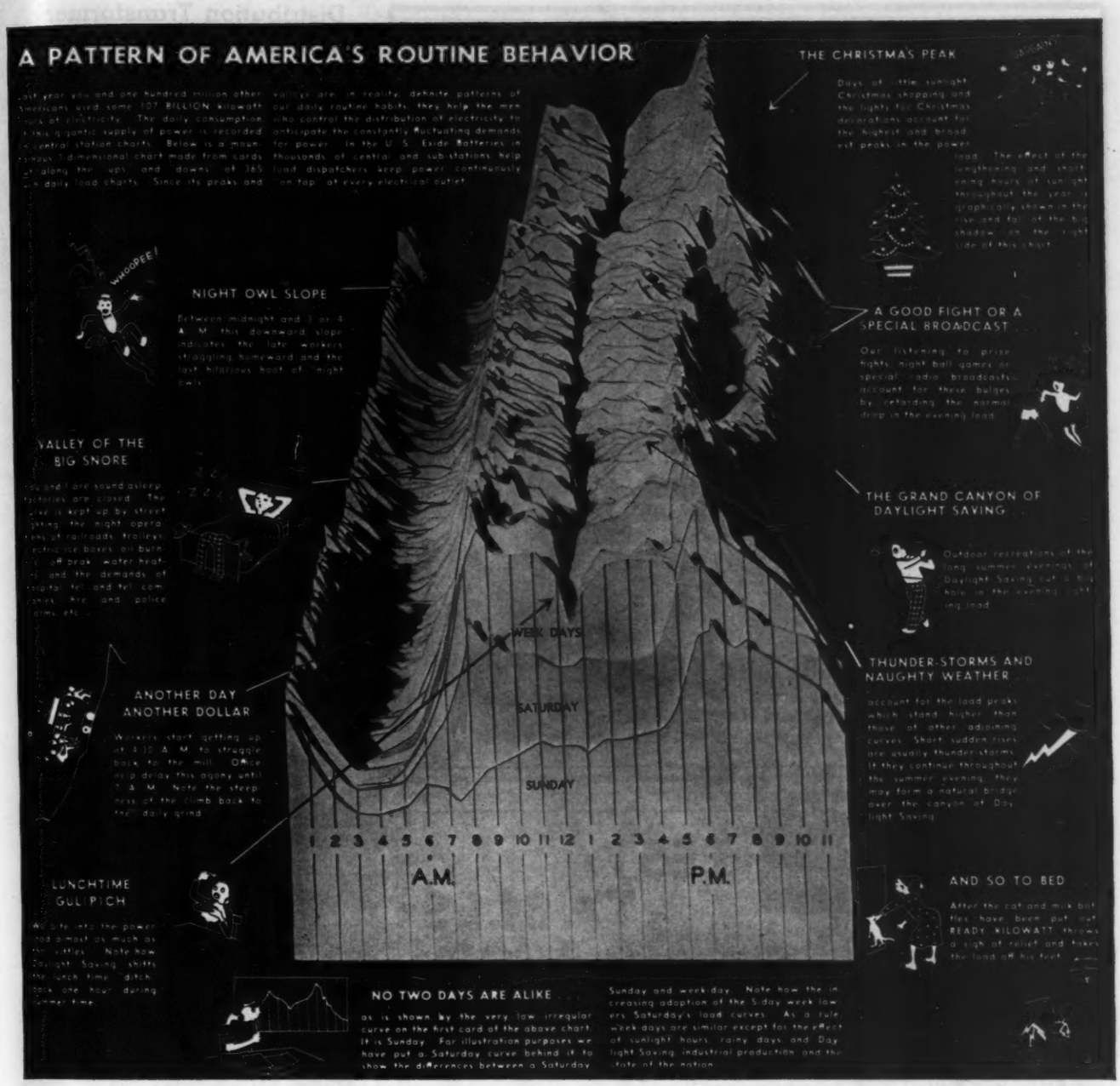
Varied orders and bids of interest throughout the territory include $13,020 American transformers for Minidoka project, $90,000 of copper cable for Rio Grande project, a quantity of bare copper wire for Parker project in Arizona, $25,500 for a turbo-electric generator for Burbank, Calif.; a 60-kv. transmission and 2,300-volt distribution line connecting four pumping plants near Oakley, Calif.; three 36,000-kva. transformers for Grand Coulee, and a $114,122 award for 230-kv. Kelso Chehalis section of Bonneville system.

NEW ENGLAND

A bright spot in the present trend in sales is a high rate of industrial activity throughout this district. Steady placement of machine tool orders by the government is keeping builders busy on full time. Two important orders for vacuum cleaners for an indefinite figure have been given to Spencer Turbine Co., Hartford, Conn., and the Sweeper-Vac Co., Worcester, Mass.

Plans for further additions in machines and electrical equipment at the Boston Navy yard call for one vertical cylindrical-type tempering electric furnace. During the first two months of 1940 arc-welder activity resulted in sales of a group of six 150-amp. machines in this district and a doubling of orders for accessories. Connecticut Light & Power Co. extended its electric distribution lines into unserved territory by the addition of 168 miles of line serving 396 projects.

More than $1,000,000 is involved in plans for adding 240 telephone circuits between Boston and New York, via Hartford, Conn. For boosting this service vacuum tube amplifiers will be spaced at 15-mile intervals. A 55,000-ft. cable costing $41,000 has been installed for telephone service between Block Island and Point Judith, R. I. The Gloucester, Mass., municipal council has authorized the installation of mercury-vapor lights on Main Street.


A PATTERN OF AMERICA'S ROUTINE BEHAVIOR
THE CHRISTMAS PEAK
NIGHT OWL SLOPE
A GOOD FIGHT OR A SPECIAL BROADCAST
VALLEY OF THE BIG SNORE
THE GRAND CANYON OF DAYLIGHT SAVING
WEEK DAYS
SATURDAY
SUNDAY
ANOTHER DAY ANOTHER DOLLAR
THUNDER-STORMS AND NAUGHTY WEATHER
1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11
A.M.
P.M.
LUNCHTIME GULPITCH
AND SO TO BED
NO TWO DAYS ARE ALIKE

The above chart was made from data supplied by the Philadelphia Electric Company. Further information in folder will be sent upon request.

A PICTURE OF YOUR BUSINESS

. . . is being drawn every day by the pens of load-recording meters in electric power stations. If you should cut out cards following the "ups" and "downs" of 365 consecutive daily load charts, and put them together, the result will graphically portray the magnitude of your job, as well as define the routine behavior patterns of the hundred million users of electric power.

Supplying power on split-second notice to a nation which uses over 100 BILLION kilowatt hours of electric energy each year is a task of mountainous proportions. It is a job challenging the ingenuity of every utility worker, and it tests the efficiency and dependability of every piece of electric generating and transmission equipment.

Because absolutely dependable equipment plays so big a part in the performance of this job, Exide Control Bus Batteries have been selected for the operation of circuit-breakers and control equipment in thousands of central and substations. You can depend upon Exide Control Bus Batteries at all times to help you keep power continuously "on tap" at every electrical outlet.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

AMELECTRIC
WIRES and CABLES

POWER CABLE
Paper Insulated
Varnished Cambric Insulated

TELEPHONE CABLE

BARE COPPER WIRE AND CABLE

WEATHERPROOF WIRE AND CABLE

MAGNET WIRE
Plain Enamel, Paper, Cotton Silk and Glass Insulated

"QUALITY ABOVE SPECIFICATIONS"

TROLLEY WIRE

KENNECOTT WIRE AND CABLE COMPANY
Subsidiary of KENNECOTT COPPER CORPORATION
PHILLIPSDALE, RHODE ISLAND
New York, 10 E. 40th St. - Chicago, 140 So. Dearborn St. - Cincinnati, Traction Bldg.

STATES TESTING EQUIPMENT

TEST TABLES

Form "TA"

For testing
Watthour Meters
Demand Meters
Relays
Transformers

Picture These Tables in YOUR Department!

Safer, handier, better equipped—these tables meet the demand of the times.

1. Tests Socket and Bottom Terminal meters.
2. All switches are of dead front type.
3. Insulation break down test provided.
4. Inclined panel to aid visibility and accessability.
5. All bus and wiring enclosed.

See Cat. No. 1, Sec. 3B for full details.

Form "FA"

The States Company
New Park Ave. Hartford, Conn.

STATES TESTING EQUIPMENT

Distribution Transformer Standardization

[*Continued from page 70*]

and 11,500-115/230-volt transformers shall be listed respectively as 7,200-120/240 and 12,000-120/240 volts.

Studies of electrical performance characteristics for this range of transformers are under way by the joint committee, but will not be completed for inclusion in the present report.

Available This Summer

It is not expected that the standardized designs will be generally available until some time in July, because it will take nearly that long to prepare drawings, design and produce the tools and develop the production procedure. Present stocks will also have to be disposed of.

The joint committee is comprised of an E.E.I. group consisting of A. E. Silver (chairman), H. A. Enos, Merrill DeMerit and E. J. Sayles and a N.E.M.A. group consisting of J. J. Mullen (chairman), A. E. Farmer, A. E. Herzberg and H. F. McRell. The joint committee acknowledges the assistance of the following in developing the standards: E.E.I., G. A. Brokaw, Jr., A. B. Campbell, E. H. Kendall, D. M. MacGregor; N.E.M.A., J. K. Hodnette, J. B. Hodtum, H. M. Jalonack, H. B. Keath and M. F. Mitschrich.

•

Missouri River Project

The Corps of Engineers is beginning a review of its "308" report on the Missouri River in South Dakota to determine whether power can be developed there to aid the exploitation of deposits of manganese and other strategic materials. Representative Francis Case, sponsor of the project, said that power can probably be generated at a wide bend in the river near Chamberlin.

•

Rural Services Extended

Since the creation of the Mississippi REA by the Legislature in 1936 more than 9,000 miles of electric lines have been built or will shortly be completed by 22 electric power associations, E. A. Ford, chairman of the board of directors of the Mississippi REA, has announced. Mr. Ford reports that $7,500,000 has been expended on the new lines, bringing service to 32,000 farm customers.

It's "TOPS"

(from Every Angle)

The Nicopress

METHOD OF SPLICING and DEAD-ENDING . . .

Once you've used the Nicopress Method of Splicing and Dead-Ending, you'll declare, as do the hundreds of present users that, "There just isn't any way of Splicing and Dead-Ending that equals the Nicopress Method for security—strength—economy and general satisfaction."

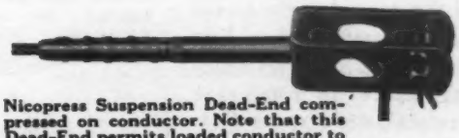
With Nicopress Splicing and Dead-End Sleeves and Tools you'll meet completely and fully all your Splicing and Dead-Ending requirements.

- Under any and all conditions, the job of installation is simple and the work quickly done, either in the air or on the ground.
- All completed splices equal or surpass the rated breaking strength of conductors.
- Both Splices and Dead-Ends are made with the same compact, light, easily operated tool.
- The splices are tight as a weld, conductors will not pull out, and completed splices are proof against radio interference.
- Completed splices have low resistance, and maintain high conductivity throughout life of line. With both offset and suspension Nicopress Dead-Ends provision is made for a tail of any desired length for tap-off or jumper.
- It will pay you to investigate "Nicopress." Write today for full detailed information and Price List R-34.

Above is shown Nicopress Splicing Sleeve and completed splice.

Nicopress No. 41 Tool for use in both splicing and Dead-Ending.

Illustrations show Nicopress offset Dead-End Sleeve and completed Dead-End installed on strain insulator—note allowance for tail.



Nicopress Suspension Dead-End compressed on conductor. Note that this Dead-End permits loaded conductor to go straight through without bending. Also note allowance for tail.

THE NATIONAL TELEPHONE SUPPLY COMPANY

5100 SUPERIOR AVE., CLEVELAND, O.

Canadian Manufacturer: N. Slater Co., Lt'd., Hamilton, Ont.
Export Distributor: International Standard Electric Corp., New York, N.Y.

IF IT'S A SPLICE MAKE IT A NATIONAL *Nicopress*

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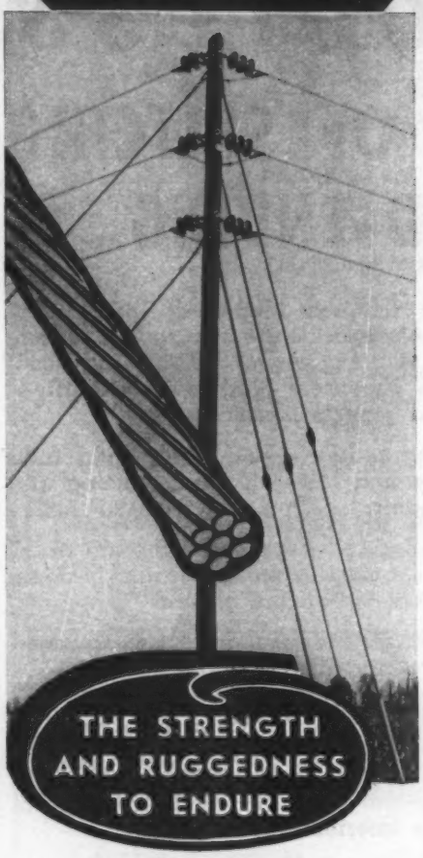
GALVANIZED STEEL
STRAND
Guy and Messenger



ALL the strength and durability practical needs require are combined—with definite economy—in Crapo Galvanized Steel Strand.

The superior tensile strength and ruggedness that only steel can provide .... the heavy, ductile, tightly-adherent protective zinc coatings .... the ability to last beyond the normal replacement period .... the comparatively low first cost of the material .... low maintenance expense .... are all significant factors in the selection of Crapo Galvanized Steel Strand for the more important construction jobs.

Crapo Galvanized Steel Strand is readily available in all standard grades and sizes from representative jobbers.

Crapo Galvanized Products also include Crapo HTC-130 and HTC-80 Steel Conductors (Solid and Stranded 3-Wire), Construction Wire, Tie Wire and Ground Wire.

INDIANA
STEEL & WIRE CO.
MUNCIE INDIANA

Recent Rate Changes

WISCONSIN ELECTRIC POWER Co. has announced a commercial rate reduction, involving a saving of $114,000 a year to stores, office and small business consumers in the Milwaukee area. The reduction is the third in the last twelve months affecting this company. It becomes effective with March meter readings. The company has been informed by the state Public Service Commission that the 10 for 1 promotional plan has been extended to July, 1941.

KENTUCKY-TENNESSEE LIGHT & POWER Co. has announced a reduction in electric rates which will benefit the consumers served by the company to the extent of $75,000 a year. This makes a combined annual reduction of $581,000 that has been secured during the last few weeks by consumers in Kentucky, Louisville Gas & Electric Co. reducing rates $325,000 and Kentucky Utilities Co. and Kentucky Power & Light Co. $181,000.

COMMUNITY PUBLIC SERVICE Co. has reduced its rates in Silver City and Lordsburg, New Mexico, $18,000 annually. The reduction in the rate for commercial service averages 11.4 per cent with savings ranging as high as 20 per cent in some instances. A reduction in the rate for general domestic service has also been made effective with January billing. The reduction averages 7.4 per cent and is as much as 17 per cent in the case of some large users.

NEW YORK STATE ELECTRIC & GAS CORP. has filed with the state Public Service Commission revised rate schedules effecting a reduction in electric rates in Granville and Salem and surrounding towns in Washington County. The changes reduce rates for residential and general service in this territory by amounts which will save consumers about $9,300 annually. It is estimated that residential consumers will save $4,600 and general commercial consumers will save $4,700 annually as a result of the reductions.

WISCONSIN RAPIDS, WIS., municipal electric utility has made an $8.000 annual reduction in rates affecting homes, business, rural and small power customers, effective May 1.

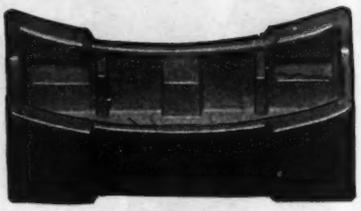
ILLINOIS COMMERCE COMMISSION has announced that Illinois residents will be saved an estimated $2,958,858 annually as a result of utility rate changes ordered by the commission during 1939. Although total rate reductions ordered during the year were $3.017,809, rate increases aggregating $58,951 were allowed, making the estimated annual saving $2,958.858. Electric service reductions totaled $2,978,436.

•

Will Construct New Unit

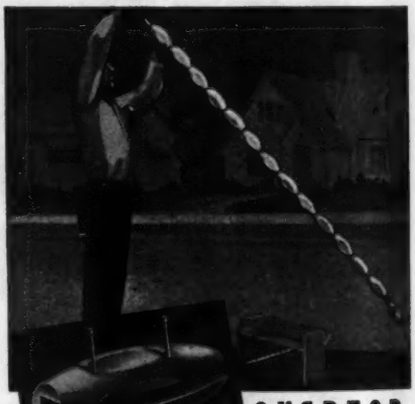
The first Iowa Hydro-Electric Cooperative, Muscatine, Iowa, has filed with the Federal Power Commission a declaration of intention to construct a 20,000-hp. hydro-electric project on the Cedar River in Muscatine and Cedar Counties, Iowa. The energy generated would be absorbed by the Eastern Iowa Light & Power Co-operative and the municipal electric system of the City of Muscatine, Iowa, the declaration states.

GUARD
AGAINST
CURRENT
DIVERSION
with
STAR
METER SEAL



Saves many thousands of dollars annually by elimination of tampering and theft of current. Seals all types CS meters effectively and permanently. Cannot be removed without destroying or multilating. SEND FOR SAMPLE.

The STAR PORCELAIN COMPANY
51 Muirhead Ave. Trenton, N. J.



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FIELD Strung together like beads on the guy wire, with TESTED strong cable clamp securely holding them in place, the 6" spindles of seasoned hardwood, aluminum coated, provide a visibility, flexibility, and economy that make Overton Flexibal the successor to old-type guy guards. Six years of testing with thousands of installations have proven its superiority and many advantages.

SEND FOR SAMPLES AND LITERATURE

S. E. OVERTON COMPANY
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Municipal Plants

BATESVILLE, MISS.—State Supreme Court has affirmed the Panola County Chancery Court decision validating $35,000 of bonds issued by the town to acquire an electric light plant and held that it is not necessary for towns or counties issuing bonds for this purpose under Chapter 185 of the laws of 1938 to state whether the bonds are to be used to buy a plant already constructed or to construct one. The court said that to require municipalities or counties, in proposing issuance of bonds, to state whether they were to be used to buy or erect an electric light plant would "defeat the purpose of the act," since it was "the manifest purpose of the act to give governing authorities authority to do what is determined to be best." Mississippi Power & Light Co. protested validation of the Batesville bonds.

NORTH BALTIMORE, OHIO—State Supreme Court has dismissed a contest of the special referendum election held last year at which voters approved ordinances and resolutions for the purchase or construction of an electric light plant.

AMHERST, OHIO—Taxpayer's suit brought against the village, requesting the Lorain County Common Pleas Court to set aside an $80,000 municipal bond issue for construction of an electric light plant has been taken under advisement by Judge Guy F. Findley. The suit alleges that the bonds were issued illegally and not in conformity with the uniform bond act. Amherst officials issued the bonds last July and sold them to Cincinnati bond brokers. The bonds are secured by a mortgage against the proposed light plant, which it is estimated will cost $145,000. The village had obtained a PWA grant of $65,000 to be used in building the plant.

MIDDLETON, WIS.—Village board has voted unanimous approval of a preliminary agreement to sell the local municipal electric distribution system to the Madison Gas & Electric Co. for $50,000. It was explained that the board's action was taken only to get the matter before the state Public Service Commission.

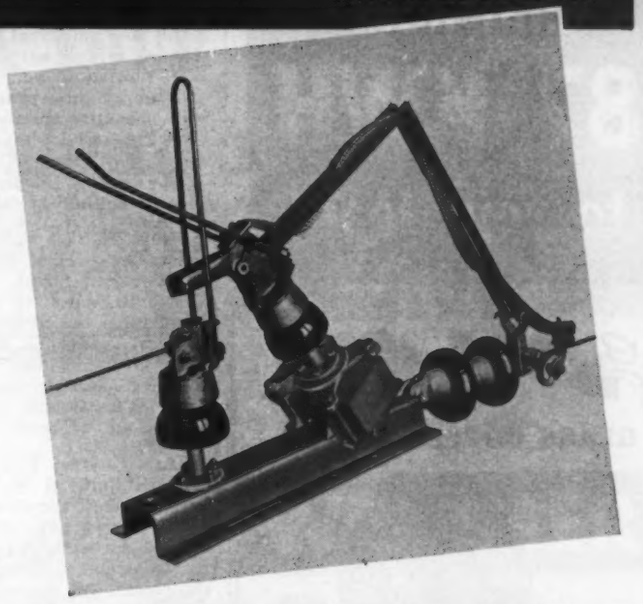
•

Public Ownership League Hits Board's Rate Order

Pennsylvania Public Utility Commission was directed to hold a hearing and fix permanent electric light and power rates to be charged by the Pennsylvania Power & Light Co. or show cause why not under a writ granted by President Judge William M. Hargest in Dauphin County Court recently on the petition of the Pennsylvania Public Ownership League.

The league filed a complaint in 1935 and the commission issued an order in September and again in December, 1938, covering new schedules. The league maintains that the commission's second order increased the rates to be charged 98 per cent of the domestic users over the rates set out in the first order and made other changes which operated to the disadvantage of the small power and commercial users.

Improved! RURAL SWITCHGEAR



"High Pressure Contacts" Among New Features of Memco Rural Switches

HERE'S A LINE of rural switches which stays within the low cost limits of rural installations yet has many of the advantages of the heavier duty type.

For instance, the group operated switches which have self aligning "high pressure contacts". Or the hook operated switches with multipoint "high pressure contacts", positive latches; and large pulling eyes to facilitate stick operation. For adjustable crossarm mounting, all switches are assembled on pressed channel bases with a combination of holes and slots in the flanges. As illustrated, group switches may use either square steel or wood crossarm for an interphase shaft.

MEMCO rural switches are available in voltage ratings from 7500 to 34500. They are rated at 200 amperes for switches listed with N.E.M.A. standard insulators or at 200 or 400 amperes for switches listed with sub-standard insulators. A letter to your MEMCO representative or directly to us will give you price and other information concerning these improved rural switches.

Before specifying for your next rural installation write for Bulletin 397 which has helpful dimensional and technical data on these low cost switches.

"Specify MEMCO Switchgear"

MEMCO ENGINEERING & MANUFACTURING CO., Inc. LONG ISLAND CITY, N. Y.

HERE'S AN APPLIANCE that adds 87 KWH to your load!

Genuine SILEX

GLASS COFFEE MAKER

BRETTON BLACK ELECTRIC MODEL with wide neck for easy cleaning

$4.95 *retail*

Edison Electric Institute figures show a waffle iron adds only an average of 60 KWH a year to your load. A toaster and a washing machine but 30 each. Even an automatic iron adds only 80 KWH. But . . . tests show an electric Silex averages 87 KWH a year! (Anyheet models, 97 KWH).

• • •

What's more . . . a Silex is easy to sell. Women bought 2700%—yes, 2700%—more Silex Glass Coffee Makers in 1939 than in 1929. And they use them every day!

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Push the appliance that increases your load fast . . . and plenty. Call in your Silex representative today . . . He's full of promotion ideas that sell!

PYREX BRAND GLASS USED EXCLUSIVELY

THE SILEX COMPANY
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Sales Opportunities

LOUISVILLE, NEB.—Nebraska Power Co., Omaha, Neb., plans extensions in transmission lines in vicinity of Louisville. Application has been made for permission. Work is scheduled to begin soon.

KNOXVILLE, TENN.—Knoxville Electric Power and Water Board, 626 South Gay Street, M. C. Bartlett, general manager, receives bids until March 13 for equipment for municipal electric distribution system, as follows: 1500-kva., single circuit substation unit (Section 1); four 1600-amp., three-phase, vault-type, open wall mounting network protectors (Section 2); voltage regulators (Section 3). Burns & McDonnell Engineering Co., 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

TROY, N. Y.—United States Engineer Office, New York District, Army Base, 39 Whitehall Street, New York, receives bids until March 19 for construction and installation of electrical equipment and auxiliary apparatus at Federal lock and dam, Troy, including high-tension service, electrical heating units, lighting service, interlocking system, valve-operating mechanisms, etc. (Circular 216).

CLAY CENTER, KAN.—City Council has engaged Burns & McDonnell Engineering Co., 107 West Linwood Boulevard, Kansas City, Mo., to make surveys and estimates of cost for extensions and improvements in municipal power plant. Additional equipment will be installed. Proposed to carry out work in spring.

EAST MOLINE, ILL.—International Harvester Co., 180 North Michigan Avenue, Chicago, Ill., plans installation of motors and controls, regulators, conveyors, electric hoists and other equipment in new one-story addition, 390 x 770 feet, to branch plant at East Moline. Cost estimated close to $1,000,000, including machinery. Bids are scheduled to be asked soon on general erection contract. James D. McGann, first noted address, is superintendent of buildings.

SACRAMENTO, CALIF.—Public Utilities Committee of State Assembly and Finance Committee of State Senate, Capital Building, Sacramento, are considering proposals for a bond issue of $50,000,000, to be used for construction of transmission lines, power substations and switching stations, and distribution systems in different parts of State, to utilize power from Central Valley project of Federal Government, now in course of construction.

TOLEDO, OHIO—Toledo Edison Co. has plans under way for expansion in Acme steam-electric generating station, to include installation of new 50,000-kw. turbine-generator unit and accessories, high-pressure boilers and complete auxiliary equipment, switchyard extensions and miscellaneous work. Extensions will be made in main feeder lines and power substation facilities. Cost estimated close to $4,500,000. Completion is scheduled in 1941. This is part of 1940 expansion and improvement program of company, for which financing is now being arranged.

MONTICELLO, ILL.—Illinois-Iowa Power Co., Monticello, plans extensions in priary and secondary lines in parts of St. Clair and Morgan Counties for expansion in rural electric system.

ABERDEEN, WASH.—Aberdeen Plywood Co., Aberdeen, plans installation of motors and controls, regulators, conveyors, electric hoists, power substation apparatus and other equipment in connection with rebuilding of local mill, recently destroyed by fire. Loss reported over $600,000, including machinery.

PORTLAND, ORE.—Administrator, Bonneville Project, Department of Interior, 811 N. E. Oregon Street, Portland, receives bids until March 14 for construction of 115-kv., wood pole transmission line from point near Bonneville, Ore., hydroelectric power station to power substation at Hood River, Ore. (Circular 813). Also, until March 15 for three 10,000-kva. transformers (Circular 810).

BROOKFIELD, MO.—Missouri Power & Light Co., Kansas City, Mo., has plans maturing for expansion and improvements in steam-electric generating station at Brookfield, to include installation of new 5000-kw. turbine-generator unit, boilers and auxiliary equipment. Switchyard facilities will be enlarged and extensions made in transmission lines. Entire project reported to cost close to $550,000.

MIDDLETOWN, CONN.—Russell Manufacturing Co., Middletown, manufacturer of automobile brake lining and allied products, plans installation of motors and controls, conveyors, regulators and other equipment in connection with rebuilding of portion of plant, recently destroyed by fire. Loss reported close to $350,000.

GRAND FORKS, N. D.—Nodak Rural Electric Cooperative, Inc., E. A. Walters, secretary-treasurer, has completed plans and will take bids soon for new electric power plant on local site, for rural electric system, previously referred to in these columns, with initial installation to include three Diesel engine-driven generating units and accessories, and ultimate plant to have five such units, all 500-kw. capacity. Fund of $225,000 has been arranged through Federal aid. Ellerbe & Co., First National Bank Building, St. Paul, Minn., are consulting engineers.

NEW CASTLE, PA.—Pennsylvania Power Co. will begin erection soon of new one and two-story and basement equipment, service and operating headquarters building, 130 x 355 feet, on local site, including garage facilities for company motor fleet. Cost close to $200,000, with equipment.

CHICAGO, ILL.—Signal Corps Procurement District, 1819 West Pershing Road, Chicago, receives bids until March 27 for quantity of switchboard equipment and other electrical apparatus, including 18 universal trunk boards, three power boards, six dynamotor ringing machines, three rectifiers, three main line and trunk distribution frames, quantity of condensers, coils, terminals, etc., and three motor-generator sets (Circular 188).

ALBANY, ORE.—Mountain States Power Co. plans extensions in primary and secondary lines in different parts of territory, including rural districts, totaling over 200 miles, with power substation and service facilities. Work will be carried out during 1940 and will form part of expansion program of company for that year. Cost estimated close to $300,000.

FORT PECK, MONT.—United States Engineer Office, Missouri River Division, Davidson Building, Kansas City, Mo., will take bids soon for penstocks and substructure for Fort Peck hydroelectric power development.

New Funds Allotted for Rural Projects

Allotments totaling $252,000 for rural electrification systems in five states have recently been announced by Harry Slattery, Administrator of Rural Electrification. These allotments provide for the establishment of one new system and the enlargement of four others.

An allotment in Idaho permits money previously set aside for a generating plant to be used for distribution lines. The new system will provide service for approximately 400 farm families in Oklahoma.

Administrator Slattery also announced allotments totaling $38,000 for financing wiring and plumbing installations in five states.

These allotments bring the total loans approved by REA since its establishment in 1935 to $269,396,793.

Details of new allotments follow:

CALIFORNIA—Plumas-Sierra Rural Electric Co-operative, Inc., Portola, J. N. Laughlin, supt., $20,000 to complete the system, which previously has been allotted $308,000 to build 223 miles of line to serve 634 members in Plumas and Lassen counties.

COLORADO—Intermountain Rural Electric Association, Bailey, George G. Eaton, supt., $12,000 to complete the system, which previously has been allotted $109,000 to build 92 miles of line to serve 300 members in Jefferson and Park counties.

FLORIDA—Clay County Electric Co-operative Assn., Inc., Keystone Heights, Copeland S. James, supt., $50,000 for installation of an additional Diesel generating unit of approximately 450 kw. capacity.

IDAHO—Northern Idaho Rural Electrical Rehabilitation Assn., Inc., Sandpoint, Glen A. Smothers, supt., $75,000 to build 55 miles of line, 151 members in Bonner and Boundary counties.

OKLAHOMA—Southeastern Electric Co-operative, Durant, J. R. Qualls, president, $95,000 to build 110 miles of line, 399 members in Bryan County.

Construction contracts recently approved follow:

ALABAMA—Wiregrass Electric Co-operative, Inc., Hartford, Gordon Persons & Co., Montgomery, engineer, contract to Stuart C. Irby Co., Jackson, Miss., for building entire project, 388 miles of line, 877 members; bid $194,755.

ARKANSAS—Carroll Electric Co-operative Corp., Berryville, Paul F. Arnold, supt., and M. A. Newcomb and Ray W. Chanaberry, Inc., Louisville, Ky., engineers, contracts to Killoren Electric Co., Appleton, Wis., and the Codell Construction Co., Winchester, Ky., two additional sections of its power system, 225 miles, 504 members, 210 miles of line, 400 members; bids $112,074 and $100,053 respectively.

GEORGIA—Jefferson County Electric Membership Corp., Louisville, James B. Polhill, Jr., supt., and J. B. McCrary Engineering Corp., Atlanta, Ga., engineer, contract to Edward S. Moore and Sons, St. Petersburg, Fla., another section of power system, 375 miles of line, 1,248 members; bid $203,166.

ILLINOIS—Menard Electric Co-operative, Petersburg, A. E. Becker, supt., and the

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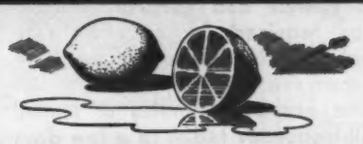

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There is no limit to the products that can be finished with porcelain enamel. For instance, weather-resistant porcelain has just recently been applied to poleline hardware and transformers—an indication that many new uses exist for porcelain, particularly in the electrical industry.

Let Ferro show you how to increase the durability and sales-appeal of your product by using the right finish. Send for this FREE booklet: "The Finish On Your Product." It contains a complete discussion of the best type of finish for various kinds of merchandise.

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Gentlemen:
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Customer Usage Data

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- **In Less Time**
- **With Greater Accuracy**

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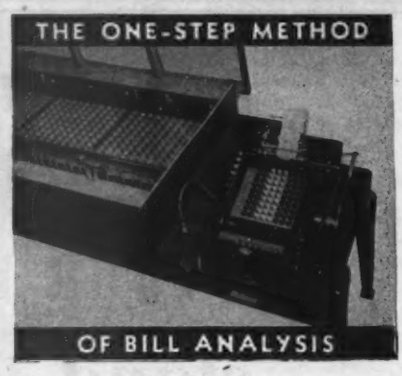

It is to your advantage to investigate R & S service on Current and Special Bill Analyses. Let us prove the economy of the ONE-STEP METHOD by an estimate on your requirements.

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Stanley Engineering Co., Muscatine, Iowa, engineer, contract to Donovan Contracting Co., St. Paul, Minn., another section of power system, 90 miles of line, 191 members; bid $66,202.

INDIANA — Decatur County REMC, Greensburg, Bevington-Williams, Inc., Indianapolis, Ind., engineer, contract to Hardin and Scott, New Albany, Ind., for building second section of system, 68 miles of line, 213 members; bid $48,412.

IOWA—Greene County Rural Electric Co-operative, Jefferson, Clifford E. Unz, supt., and Kenneth R. Brown, Des Moines, Iowa, engineer, contract to Hoak Construction Co., West Des Moines, for building another section of this system, 224 miles of line, 458 members; bid $134,108.

KANSAS—C & W Rural Electrification Co-operative Association, Inc., Clay Center, Irvin H. Smith, supt., and Raymond H. Reed, Abilene, Kans., engineer, contract to the Grundeman Construction Co., Holton, Kans., another section of power system, 85 miles of line, 170 members; bid $51,663.

KENTUCKY—Warren Rural Electric Co-operative Corp., Inc., Bowling Green, Lester Wright, supt., and P. M. Sullivan, Gallatin, Tenn., engineer, contract to John Oman, Jr., Nashville, Tenn., for building another section of power system, 150 miles of line, 525 members; bid $95,307.

LOUISIANA—Valley Electric Membership Corp., Natchitoches, E. J. Giering, Jr., supt., and Ray W. Chanaberry, Inc., Louisville, Ky., engineer, contract to Stuart C. Irby Co., Jackson, Miss., another section of power system, 185 miles of line, 403 members; bid $82,997.

MINNESOTA—Lake Region Co-operative Electrical Association, Fergus Falls, Albert R. Knutson, supt., and A. J. Christopherson, Fergus Falls, Minn., engineer, contract to Megarry Brothers, St. Cloud, Minn., another section of project, 165 miles of line, 314 members; bid $103,820.

MISSISSIPPI—Yazoo Valley Electric Power Assn., Yazoo City, C. N. Blakemore, supt., and Bowman and Bowman, Greenwood, Miss., engineer, contract to Sullivan, Long and Hagerty, Bessemer, Ala., another section of project, 120 miles of line, 275 members; bid $65,951.

MISSOURI—Three Rivers Electric Co-operative, Linn, Steve A. Schauwecker, supt., and A. Y. Taylor & Co., Clayton, Mo., engineer, contract to Acme Construction Co., St. Paul, Minn., first section of power system, 256 miles of line, 517 members; bid $174,000.

OHIO—Hancock-Wood Electric Co-operative, Inc., North Baltimore, R. P. Luse, supt., and Putnam and Woolpert, Dayton, Ohio, engineer, contract to the D & W Construction Co., Columbus, Ohio, another section of project, 190 miles of line, 547 members; bid $133,607.

OKLAHOMA—Caddo Electric Co-operative, Binger, Billie Bryan, supt., and C. H. Buernsey & Co., Cherokee, Okla., engineer, contract to Reinhart & Donovan Co., Oklahoma City, Okla., another section of project, 55 miles of line, 92 members; bid $33,528.

OREGON—Benton-Lincoln Electric Co-operative, Inc., Corvallis, Guy Thomas, supt., and John W. Cunningham, Portland, Ore., engineer, contract to Newport Construction Co., Portland, Ore., entire power system, 190 miles of line, 475 members; bid $170,725.

PENNSYLVANIA—Warren Electric Co-operative, Inc., Pittsfield, F. H. Curry, supt., and Gibbs & Hill, Inc., Pennsylvania Station, New York, engineer, contract to Midland Constructors, Inc., Chicago, Ill., entire power system, 162 miles of line, 584 members; bid $116,643.

Luminous Ceiling Gives 100-Ft.-Candles

[*Continued from page 65*]

3. It provides ready access to the main wiring channel and to the auxiliaries (the acoustic panels are instantly removable).

There will be 1,154 lamps in the complete installation. Standard arrangement is two lamps end to end in a 2x6-ft. metal box (5 watts per square foot without auxiliaries). Lamps are wired three-phase on a 120-208-volt network supply and they are rotated as to phase both transversely and longitudinally to the room axis so as to eliminate strobe. There are two switching centers, one in each of the two building wings, adjacent to the cabinets that serve this floor; 23 switches control the entire load. They are triple-pole, 30-amp., 250-volt motor switches. The largest number of lamps on a branch circuit is 64 and the smallest number is 40. There is no noticeable 60-cycle hum, vibration or strobe. So far as the engineering department is concerned, the lighting compared with the old quarters is revolutionary, although the watts per square foot are almost precisely the same as they were before. The impression of most people entering the room is that they have come out on an unroofed area, so closely does the effect resemble unobstructed daylight. The average horizontal illumination at an elevation of 37 in. is 85.5, the minimum value is 65.3 and the maximum 103.1.

Cost of the installation has been the subject of much discussion among visitors who have seen it. The fixtures delivered cost approximately $10,000 without auxiliaries, tubes or switches. Erection was by the Commonwealth Edison Company electrical maintenance staff.

It should be remembered that the installation is rather a special one. General clerical or office work, for example, does not require entire absence of shadows or paper shine and it is assumed that for such spaces a modification of the drafting room layout would be ideal; that is, the equipment might consist of standardized detached inclosures as shallow as possible, with perhaps one foot or so of space between them, which might be for the accommodation of sprinkler heads or other ceiling obstructions. The cost of such an installation might be about half the figure mentioned for this drafting room.

VIA

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SIGNALING UNITS

THE circuit diagram in the arrow shows how simply a pair of Bendix-Cory Autosyns transmit instrument readings to remote points. Pressure, station load, r.p.m., position, rate-of-flow, count, dimension, liquid level—almost any measure—may thus be read at a distance in one or several places. Several sizes and types. Type 851 (shown) produces 2.5 inch-ounces of torque at 90° angular displacement—safe continuous operating torque 1.1 inch-ounces. Weight 15.3 ozs. Dimensions 2⅜" x 3-15/32". Other Autosyns operate within an accuracy range of 1° + or — (½° + or — on special order).

One Autosyn Transmitter can actuate several variously located receivers for remote instrument readings.

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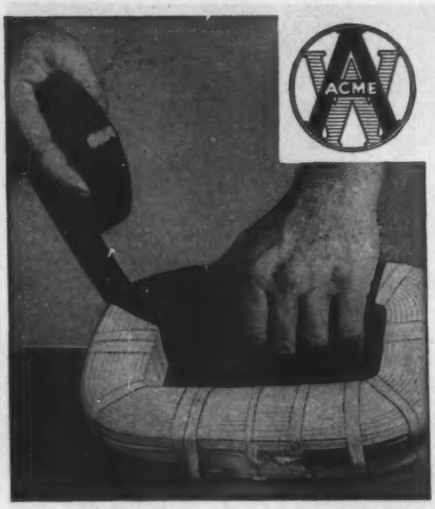

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UTILEGALITIES

By WILLIAM L. GROSSMAN
Instructor in Public Utilities, New York University

Not an Expert Accountant Anyone familiar with the operation of municipal electric plants is not impressed when he is told by utility baiters not only that such plants charge lower rates than private companies but also that the revenues earned by municipal plants completely cover the cost of producing the service. For how can one ascertain cost of production in view of the Wonderland methods—if they may be so dignified—that exist in municipal plant accounting? The subject is brought to mind by a decision in which the Appellate Division of the New York Supreme Court upholds, as against a commission order, the right of a village to place in the property accounts of its electric plant construction overheads and other capital expenditures erroneously charged, during a 20-year period of unregulated accounting, to operating expenses (Wellsville vs. Maltbie, Nov. 1, 1939). "The present plant superintendent," says the court, "has been in charge since 1920, and its accounting system has been under his supervision and direction since that date." With delicate understatement, the court then adds: "He is not an expert accountant." It might have explained further that this makes him fairly typical of the individuals who supervise accounting in small publicly owned plants.

The fundamental principle of the case—that a utility enterprise should be permitted to correct an innocent undercharge to capital—appears to be sound. Indeed, a denial of this principle would seriously handicap the commissions in their efforts to make books of accounts significant and useful for rate-making purposes.

* * *

Misconception The daily newspaper columnist, apparently competent, not to say omniscient, in every conceivable field of inquiry from Aerostatics to Zoroastrianism, generally proves a disappointment to the reader who happens to have specialized knowledge of the particular subject on which the columnist is, at the moment, holding forth. For example, persons who have studied utility law will wonder at the statement of one of our popular columnists, commenting on the S.E.C.'s refusal to authorize the sale of $10,000,000 in Consumers Power bonds, to the effect that the dividends that may be paid on the stock that the company may issue in place of the proposed bonds will "of course" become a burden on electric light rates." This is an expression of the popular misconception that rates depend upon capitalization. For more than forty years, however, it has been fundamental law that utility rates need not be fixed with reference to interest and dividend requirements. Both government control of utility capitalization and criticism of the exercise of such control must find their justification apart from the effect of securities on rates.

* * *

State Rule A recent decision of the United States Supreme Court (Oklahoma Packing Co. vs. Oklahoma Gas & Electric Co.) throws the cold light of judicial detachment upon one aspect of the contention between the federal government and the states for utility control. It seems that the utility company in question appealed to the Oklahoma Supreme Court from a rate-reduction order of the Oklahoma Corporation Commission. The reduction was stayed pending the appeal, but to protect a certain consumer against possible overcharge the company gave a bond. The company lost its appeal, and the consumer brought suit on the bond. The company thereupon persuaded a federal court to interfere and to enjoin the proceedings brought in the state court on the bond. The Supreme Court of the United States, in an opinion by Justice Frankfurter, now maintains that the federal court had no power to enjoin the state court proceedings. Just a few weeks ago Justice Frankfurter wrote another opinion, upholding the jurisdiction of a state commission, as opposed to a federal court, over a matter of railroad abandonment (Palmer vs. Mass.).

It is good to see a fair-minded liberal like Felix Frankfurter standing side by side with state authorities in opposition to usurpation of utility regulation by the federal government. It is good also to know that the problem can be considered dispassionately, for in the last analysis there is no issue here between liberal and conservative, but merely a struggle for adjustment in a technical matter of government efficiency. The ultimate question is, simply, In what fields, if any, can federal regulation achieve more desirable results than state regulation?

Lower Cost Electric Cookery

[*Continued from page 79*]

tion and sales. A stop at any gas station shows what it means in gasoline usage. Translating automotive language into electrical terms, we have better business in manufacturing, retail appliance sales and killowatt-hour sales through field experience trials which help to bring new standards of electrical living to all of the people connected to our lines.

There's but one answer for both home and utility where the low-income customer is concerned, and that is good low-cost equipment of new design that will adapt electricity to the housewife's needs as she sees them. Since one of the biggest jobs in her life is cooking, she is especially ready to welcome some method within her means to do this job the automatic electric way. The experience of the Central Hudson Gas & Electric Corporation during the past several years in introducing electric roasters, or ovens as we prefer to call them, into thousands of low-income homes is factual proof of that.

Low-Cost Appliance Ready

Now a new low-cost appliance has passed our field tests and is ready to do its part in bringing the advantages of electric cookery into the homes of low-income customers.

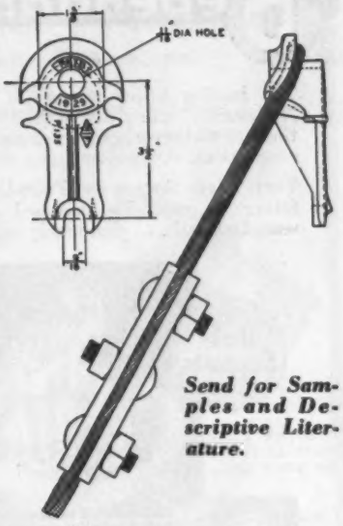
The equipment consists of an assembled table-top unit, having a roaster or oven section, with baking racks and oven dishes, and a flexible three-heat surface unit, broiler drawer, aluminum grill. It roasts, bakes, broils, fries, boils, grills, does everything that a standard electric range will do. It will serve economically a family of two or ten and never let a hearty appetite down. The automatic oven control can be supplemented with a time clock at small extra cost. The equipment is light, easy to handle, easy to use, easy to keep clean. Straight, simple lines and the black and white porcelain enamel combine to make it an attractive addition to the kitchen.

A visit to the home of a Central Hudson customer where one of these table-top ranges has been doing all the cooking for a family of five for 3½ months gives the candid inside success story.

When this call was made the housewife was sitting on the porch doing

800,000 Installations Can't Be Wrong

The supplement with Electrical World issue of May 6, 1939, lists 145 Largest Generating and Distributing Systems in the U. S. 48 of these representative Companies and many other smaller properties regularly use M. I. F. Through-bolt Guy Hooks on exclusive or preferred specification basis. Investigation pays.



Guy Hooks— Three principal types in addition to the P134 Crossarm Guy Hook. P135 rated at 13,000 lbs. on ⅝" through-bolt is widely used for rural electrification. P133 rated at 20,000 lbs. on ¾" through-bolt. P132 rated at 40,000 lbs. on 1" through-bolt. Make up guy loops on the ground and save time of the whole gang. Prices as low as 15c each in quantity.

Eye Nuts and Anchor Rods— Thimbleless Eye Nuts for ⅝" bolt as low as 12c each in quantity. Larger sizes for ¾" and 1" bolts. Double Eye Nuts and various types of Bolt Eyes also available. Also furnished assembled and galvanized as unit on special steel rods of any desired length, rated at 80,000 lbs. per sq. in. at correspondingly attractive prices. These Eyes, used with standard stocks of through-bolts, round out simple specifications for pole-to-pole guys, etc., other than anchor type served by the Guy Hooks.

Curved Washers— Full line of Curved Ribbed Malleable Washers using the metal to better advantage than plate washers of uniform thickness, minimizing the pole-splitting stresses of through-bolt guying of any type, and strictly competitive as to price.

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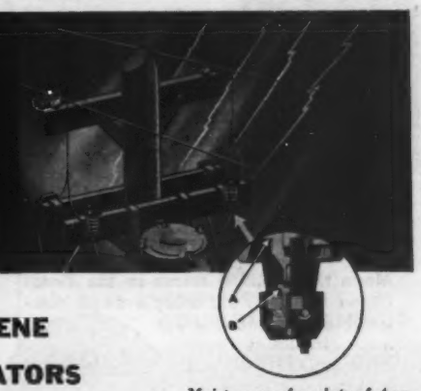

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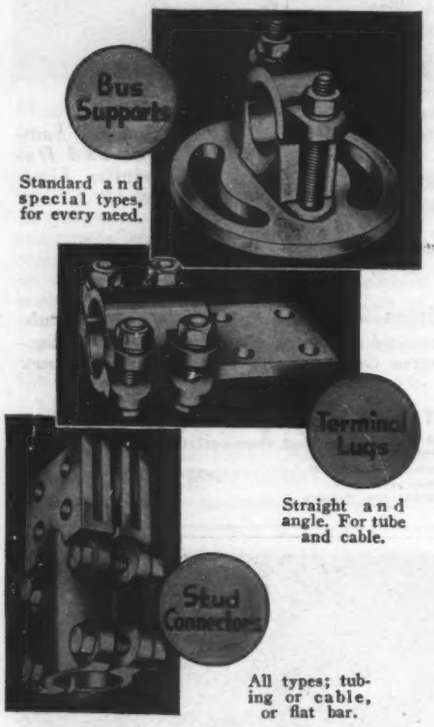

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the mending, while three young examples of perpetual motion were romping about in the yard. The home is in the country off the main thoroughfare on a little winding dirt road. Out on the air floated appetizing odors from the dinner that was getting along all right by itself in the electric oven. Everybody trooped in to see this kitchen magic at work. The customer lifted the oven cover to reveal a meat loaf browning beautifully, creamy scalloped potatoes and buttered carrots in the three baking utensils. A couple of days before there had been roast lamb keeping company with string beans and browned potatoes. Sunday it had been roast chicken with dressing, and corn on the cob, and at night toasted chicken sandwiches.

"It's grand to have an oven I can regulate just right and don't have to watch," the customer reported, "saves me a lot of time. Nothing burns. I like doing the whole meal at one time in the oven. I cook a lot that way. It keeps the kitchen cooler, too. The grill fries nicely, but I use more broiled and oven-roasted meats than fried ones. The grill is especially good for frying eggs and making griddle cakes. The whole thing is easy to clean. I can pull out the broiler drawer and take it right over to the sink to wash it. The same way with the oven. It saves a lot of scouring pots and pans, too. I use it for all my cooking. The center part on the top is handy when there's just one hot dish to prepare."

The customer herself could hardly decide what feature she liked most. It is the whole idea of electric cooking that appeals to her, but she thinks that the automatic operation of the oven means the most in her busy day.

Uses 64 Kw.-Hr.

"Have you any idea how much it costs you to cook with electricity?" she was also asked.

"Oh, not very much—maybe $2 or $2.50 a month," was her estimate. A subsequent check with the company's records showed that it was actually costing between those limits on the 3½-cent step, or about 64 kw.-hr.

Before this she had been using a coal range with an oil burner and was enthusiastic about the improved results of everything cooked the electric way. The old range is used in summer just to heat water in addition to the electric teakettle, but will be on the job to heat the kitchen in cold weather. This lady even then, however, has no intention of going back to the fuss, bother and uncertainty of this old timer, with the electric range in the kitchen, all set for action.

This is how the appliance, which was developed to meet a real need, provides modern automatic cooking —in its entirety—for those who could not afford the standard electric range. When we consider the cost of purchasing and using a bottled gas range, or even an oil range with built-in non-automatic oven, and compare it with the cost of having this really modern equipment, we have some idea of the possibilities for volume sales. The $2 or $2.50 additional revenue a month from each of these ranges in the home is good business for the electric companies right down the alley where they need it most—among the low-income, small-user families, who are non-profitable customers. Most of them are ready and glad to spend what they can afford for better living. They have been waiting for the electric industry to make this possible.

Here's one answer to the problem of building sound business for the utility company, because it is the answer to the real daily needs of our largest group of customers, the low-income families.

•

Utility Combines Projects

FPC has authorized the issuance to the Nevada-California Electric Corp. of a license for Project No. 1394, upon the surrender of its licenses for Projects Nos. 374 and 595-607, which had been separately licensed but were found by the commission to be integral parts of the larger project. Most of the proposed units of the project have been completed and are in operation. The project is located in Ingo County, California.

•

Merge Free Laboratories

The United States Testing Co., Inc., has merged the personnel and facilities of the E. E. Free Laboratories with the testing company. E. A. Graham, formerly associated with Dr. Free, will manage the laboratories, which will continue in its present location in New York and will be known as the engineering and research division of the testing company.

LETTERS TO THE EDITOR

Public Funds for Research

To the Editor of ELECTRICAL WORLD:

May I take exception to the natural inference to be drawn from the editorial entitled "An Unfair Comparison," appearing in the January 27 issue of the ELECTRICAL WORLD, wherein you state:

"The only point we are trying to make is that REA or any other agency using public funds can make experiments of a nature and on a scale that is denied to regulated private utilities . . .

To my mind research and experiments are a legitimate use of private funds so expended in hope of future profit, but that such use of taxpayers' money is most improper and is an abuse of the taxing power of the government in assessing some taxpayers for the speculative benefit of others.

As an illustration, I would cite the many millions spent by the American Telegraph & Telephone Company in developing the wireless telephone as a proper use of the earnings of a private company, so spent in the hope of enlarged business, but which would have been a most improper use of money provided by the taxpayers of the nation for the necessities of the government.

S. FERGUSON, President
Hartford Electric Light Company.

•

Sportsmen Versus Dams

To the Editor of ELECTRICAL WORLD:

In this section of the Ozarks we are confronted with the prospect of being blessed (?) by the beneficent politicians and promoters with thirty dams of various sizes and descriptions, mostly for flood control, with the bait of "cheap electric power" included on some.

In my search for data on hydro-electric power costs, I was referred to three numbers of ELECTRICAL WORLD, April 24, 1937; July 31, 1937, and March 12, 1938. Of these I have located only the April 24, 1937, number. In that I found an editorial which gives me courage to ask you directly for help.

I am attempting to round up this information for use by the Conservation Federation of Missouri, which is primarily a group of sportsmen's organizations covering the state, and whose executive offices are located in this city. The above numbers, and any additional information available would be greatly appreciated as a means of dispelling the "cheap power" delusion which has been built up by promoters. We realize that

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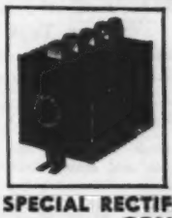
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YOUR card here builds prestige for you and helps to make your name familiar in the field. The cost is extremely small in proportion to its value as a business aid.

this will not be an easy task, although we have made progress on other premises.

We have in this region some of the finest clear water streams, fed by countless springs, existing in this country, or any other, and if these flood-control projects are not stopped not one of them will be left intact. We already have a few samples of power dams, and now three flood-control dams are in process of construction. Others are awaiting congressional appropriations, although the entire proposal was declared "economically unfeasible" when the surveys were first made.

PAUL R. NOLTING,
830–840 Medical Arts Building,
Springfield, Mo.

•

Offers $5,500,000 Bonds

Offering of a new issue of $5,500,000 Department of Water and Power of the city of Los Angeles refunding revenue bonds was recently made. The issue consists of $1,396,000 of 3¼s, maturing 1943-47, and $4,104,000 of 2¾s maturing 1947-1959. The bonds were offered at prices to yield from 1.25 to 3.00 per cent, according to maturity.

•

Insull Suits Dismissed

Federal Judge Charles G. Briggle of Chicago dismissed two suits for an accounting of $80,000,000 in Insull securities on the ground that debenture holders legally could not negotiate a double settlement. Twenty-nine holders of debentures in the defunct Insull Utility Investments, Inc., and the Corporation Securities Co. brought the suit against directors of the companies after having settled earlier with certain banks.

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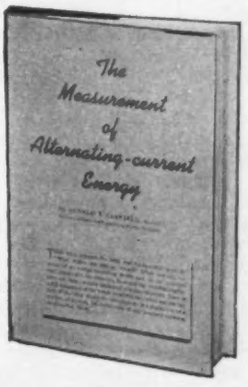
2. How can this revolving disk be made to measure energy?
3. What metering scheme should one use to measure the energy in a particular circuit?
4. How may one be sure that all the energy in such a circuit is metered by the particular scheme chosen?

The presentation is based throughout on the author's wide experience with classes of metermen.



Measurement of Alternating Current Energy

By DONALD T. CANFIELD
Associate Professor of Electrical Engineering, Purdue University

210 *pages*, 5½x8, 74 *illustrations*, $2.00

THE book begins with an outline of the development of the principles of metering. It then provides an answer to the question: What are the ways and means, together with their modifications, of producing a torque on a rotatable member by electromagnetic means?

After showing the possibilities of producing rotation in a disk by electromagnetic means, it explains why such motion must have a purpose.

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Recent Legislation

NEW YORK—New bills have been introduced in the Assembly amending the public service law which are repeats on bills introduced last year which failed of passage. They have been referred to the public service committee. Assembly Intro. No. 1,483 adds new paragraph 118 to make it unlawful for public utility corporations to keep accounts, records or memorandum other than those prescribed by public service commission or under authority of the United States. This is the same as Assembly Print No. 435 of 1939. Assembly Intro. No. 1,464, adds new paragraph 116 to authorize public service commission to prescribe uniform methods of measuring and accounting for depreciation of property to be observed by public utility companies and municipalities under its jurisdiction and to fix rates of depreciation and amounts necessary for depreciation reserves. Same as Assembly Print 436 of 1939. Under the provisions of a bill introduced in the Assembly a new section 220-f is added to the Labor Law providing that printing contracts awarded by public utility corporations, except for letter heads and envelopes, shall be performed within the state and within municipality where utility conducts its business exclusively or where the greatest amount of its business is transacted; contractor must be entitled to use label of labor organization and must comply with labor laws as to hours and wages for public works contracts. Under the provisions of a bill introduced in the Assembly and referred to internal affairs committee (Assembly Intro. No. 1.135) a new section 325-a is added to the Highway Law requiring that electric transmission, telephone, telegraph or other poles adjacent to any highway shall be painted twice a year during April and October to a height of at least 7 ft. with luminous paint of brand approved by state public works superintendent.

NEW JERSEY—A measure permitting municipalities to anticipate in 1940 budget-making the apportionments of utility taxes made by the state tax commissioner for 1938, '39 and '40 under a new legislative formula became law recently when Governor Moore filed it with the Secretary of State. The bill was the fifth in a series approved by the Legislature in January in an attempt to correct constitutional flaws in 1938 utility tax apportionment laws cited by the Court of Errors and Appeals. Four of the measures, which validated apportionment by Tax Commissioner Martin for 1938 and 1939 and which established Commissioner Martin's unit value system as the yardstick for future distribution of some $13,000,000 annually in utility taxes, previously were vetoed by the Governor and repassed into law by the legislature.

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GRDA to Get Customer

Chelsea will be the first Oklahoma town to receive Grand River power under the terms of a contract signed by LeVerne Nelson, chairman of the Chelsea Board of Trustees, and Carl A. Gerhardt, chief of the marketing department for the GRDA. The contract provides that GRDA build a line to Chelsea, a project involving about $20,000. Chelsea now has its own plant.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : "OPPORTUNITIES" : EQUIPMENT
BUSINESS : : USED OR RESALE

UNDISPLAYED —RATES— DISPLAYED

10 CENTS A WORD. MINIMUM CHARGE $2.00
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An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

Copy for new advertisements must be received by 10 A. M. Monday for the issue out Saturday.

OFFICIAL PROPOSALS

Bids: April 4 (67)

Transformers and Circuit Breakers

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY
SANTEE-COOPER PROJECT
DOCKET NO. 4329 P. R.

1. TIME AND PLACE OF OPENING BIDS: Sealed proposals for furnishing station service and main power transformers and circuit breakers for the Pinopolis Power Plant will be received by the South Carolina Public Service Authority at the office of the Engineer, Harza Engineering Company, 27 Cumberland Street, Charleston, South Carolina, until 10:00 a. m., April 4, 1940, at which time the proposals will be taken to the Ballroom of the Francis Marion Hotel where they will be publicly opened and read.

2. PROCUREMENT OF PLANS AND SPECIFICATIONS: Proposals must be submitted on the forms furnished by the Authority. These forms along with other contract documents including plans and specifications may be obtained from the office of the Secretary of the Authority, Room 508, Peoples Office Building, Charleston, S. C., upon payment of $10.00 for the first set and $3.00 per set thereafter. No refund will be made. These documents may also be examined free of charge at the office of the Authority, Columbia, and Charleston, S. C., and at the offices of the Engineer, 27 Cumberland Street, Charleston, S. C., and 205 W. Wacker Drive, Chicago, Illinois.

3. DESCRIPTION OF WORK: The Pinopolis Power Plant is located about 32 miles northerly of Charleston and 4 miles north of Moncks Corner, South Carolina. The site of the work is approximately one-half mile west of the main line of the Atlantic Coast Line Railroad to which it is connected by a branch railroad.

The work will include furnishing four 34,000 kva and one 11,350 kva forced air cooled outdoor transformers with lightning arresters, two 1,000 kva indoor self cooled transformers and fourteen 115 kv, 1,500,000 kva circuit breakers.

4. BIDDER'S BOND: Each bid must be accompanied by a certified check or bidder's bond executed by the bidder and a surety company licensed to do business in South Carolina and countersigned for the Surety by an agent or attorney-in-fact who is a bonafide resident of the State of South Carolina, in the sum of not less than five (5) percent of the amount of the bid. This is required as a guarantee that if the bid is accepted, a contract will be immediately entered into and the performance of it properly secured. The certified check or bond will be returned upon non-acceptance of bid or execution of contract.

5. WITHDRAWAL OF BID: No bid may be withdrawn for a period of thirty (30) days after the date set for opening of said bid. The Authority reserves the right to reject any or all bids and to waive informalities therein.

6. LICENSES: Bidders not fabricating any shop work in South Carolina will not become general contractors of South Carolina and will not be required to secure General Contractor's Licenses.

The General Counsel of the South Carolina Tax Commission has ruled that manufacture outside of the State, and shipping machines to the site of the project, is not subject to bidders' or Contractors' License Taxes under Section 2543 of the Civil Code of 1932.

Bidders not exempted under the above paragraphs will be required to show issuance of such licenses before his bid is opened or considered.

7. VIEWING SITE: Prospective bidders will be given assistance in viewing the site of the work upon application to the offices of the Harza Engineering Company, 27 Cumberland Street, Charleston, S. C., or Pinopolis Dam site near Moncks Corner, S. C.

By order of the Board of Directors.
SOUTH CAROLINA PUBLIC SERVICE AUTHORITY
By TOM B. PEARCE,
Chairman

ATTEST:
CHARLES H. GERALD,
Secretary.

POSITIONS VACANT

YOUNG ELECTRICAL ENGINEERING graduate wanted with good scholastic record and having creative ability and initiative for experimental development work on power distribution equipment by manufacturer in middlewest. P-731, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ENGINEER, five years experience in design of switchboards and switchgear, give complete data. P-735, Electrical World, 330 W. 42nd St., New York, N. Y.

WANTED: Experienced man to manage REA Co-op. 500 miles—1250 members. P-736, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ENGINEERING DESIGNER for high and low voltage air circuit breakers, preferably one having some interrupting test experience on same. Give full details. P-737, Electrical World, 330 W. 42nd St., New York, N, Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 30 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

EXECUTIVES AND TECHNICAL MEN. Contact employers for positions through our confidential and effective methods. We negotiate preliminary overtures. Established 24 years. Inquiries invited. H. H. Harrison, Director, The National Business Course, 20 West Jackson Blvd., Chicago.

POSITIONS WANTED

(See also "Selling Opportunities Wanted")

POSITION WANTED: General plant engineering experience. Valuation plants and equipment, fixed capital records, inventories, reclamation. Supervision, office and field, job planning, maintenance, installation, construction. Single, any location. PW-707, Electrical World, 330 W. 42nd St., New York, N. Y.

PROFESSIONAL ELECTRICAL ENGINEER 14 years experience in public utility field includes meter and instrument testing in laboratory and field; maintenance of small hydro electric plants; designing, constructing, and operating rural distribution systems; and power sales engineering. Desires connection with eastern utility. PW-729, Electrical World, 330 W. 42nd St., New York, N. Y.

ELECTRICAL ENGINEER SUPERINTENDENT, 16 years experience overhead and underground distribution and transmission design and operation. General utility operations and capable of handling men. Now employed. Age 40. PW-734, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

(Continued on opposite page)